the OIL AND GAS JOURNAL
AUGUST 25, 1958

Concluding:
FUNDAMENTALS
OF GEOCHEMISTRY
p. 132

API Tries New Route
To Public Acceptance p. 41

Refiners Are Moving In
On Aromatics Market p. 44

Aging Smackover's Problem:
Stop Pollution Without Going Broke
p. 48

The Case for Thin-Wall Pipe p. 68

New Way to Determine Chlorides
. . . in charge to cat reformer p. 94

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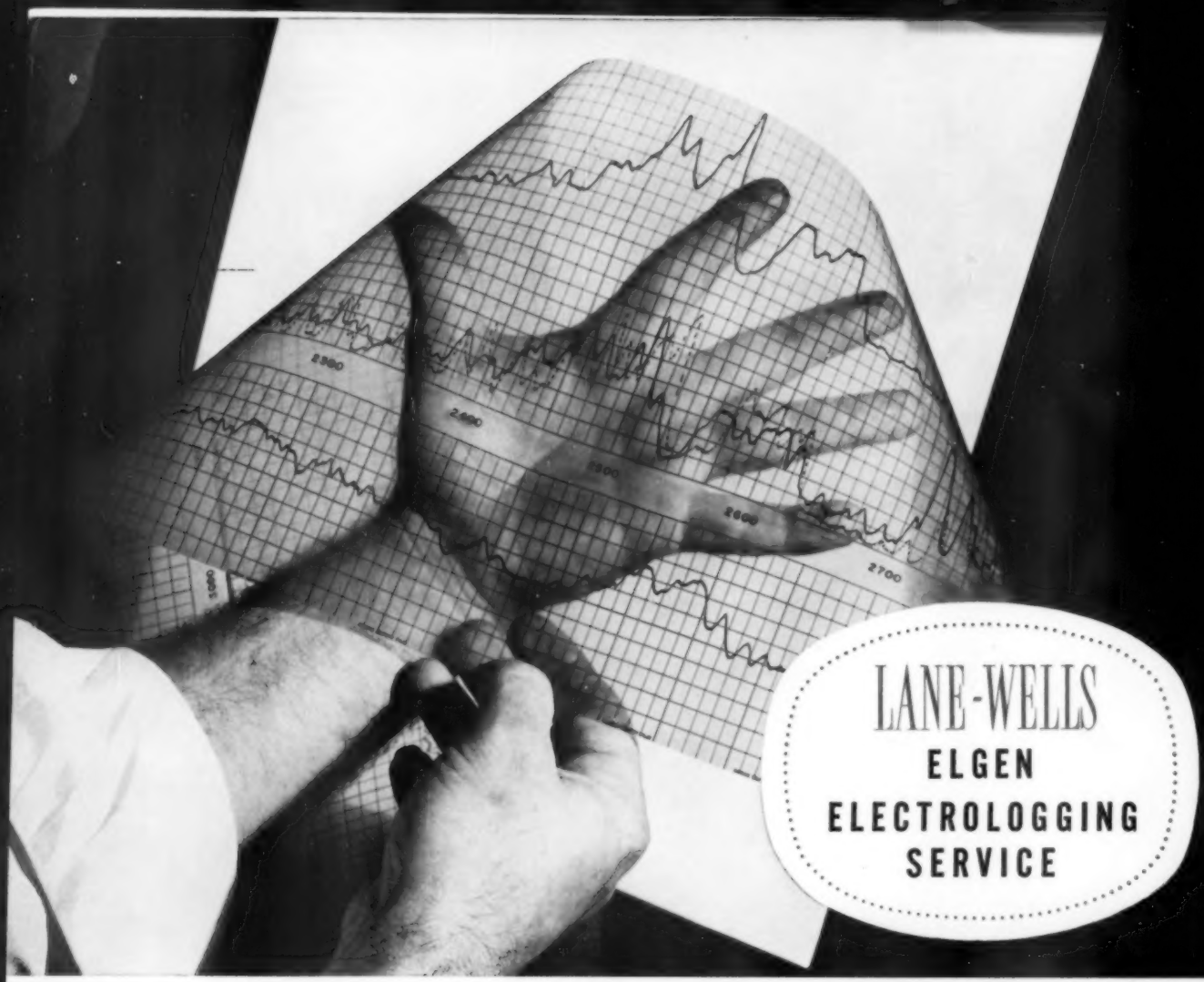

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the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Aug. 25, 1958

The oil industry is heading back to steel market:

Slight increase in demand for tubular goods and signs of life in other oil-country items are reported by steel producers.

But they point out these items have a long way to go to get back to normal. Many oil companies are still living off inventories.

However, steelmen are optimistic about the outlook. They expect demand to continue making steady gains well into next year.

Despite the August 1 price boost of $4.50 a ton, steel orders this month have been as good as June. That month was the best of the first half.

There's already talk of a possible steel strike next July 1 when 3-year labor contract expires. Threat of a shutdown will spur steel consumers to build up inventories above operating levels.

Stocks will be depleted and oil companies will be back in the steel market full swing by then.

Oil's public relations will have a new look this fall. Here's what is happening:

The OIC, which handled public relations and educational programs, and the APIC, which operated in the field of governmental affairs, are being merged on both the state and national levels (p. 41).

State organizations will be autonomous, planning and financing their own programs. Their work will be loosely coordinated by a national headquarters operating in New York through the API Committee on Public Affairs.

A Washington staff is being assembled to aid Frank Dennis in his new post as API spokesman in the nation's capital.

Aim is greater efficiency in organization and a more effective public-affairs program by taking it closer to the grass roots.

Merger of the OCAW and ICW unions appears certain. Initial steps have been taken by top union officials (p. 54). They drafted a definite timetable of preparations for the eventual merger. Details were not disclosed.

Final decision on the merger will be up to rank and file members of both unions at conventions this fall.

Rising salaries are attracting students to engineering careers.

That's shown by an impartial study of 16 top engineering schools by the College Placement Council.

Here's what the survey showed, even during a period of recession: Of the schools' June graduates, 93% already have been employed by industry or government. Because of heavy demand salaries averaged $485 a month, up $20 from last year. The range was from $325 to $735 a month.

Because of those high salaries, engineering enrollments are increasing.

An increase of 4% in enrollments this fall over last year is predicted for the 16 pilot colleges. That's based on the number of students who have indicated they will enroll this year.

How to stop pollution without going broke? That's the problem confronting Smackover field oil producers (p. 48).

The producers, mostly small operators, for years have been dumping salt water into the lower Ouachita River basin. Now that's got to stop.

Seriousness of the situation is shown by Smackover statistics: 1,500 stripper wells surfacing 300,000 bbl. of salt water per day to produce 15,000 bbl. of oil.

Many of the operators have banded together to propose a 5-year plan to lick the problem.

If successful, it might lead to another cooperative effort: Secondary-recovery projects for Smackover.

And along that line: A man-made river will play a part in future pollution abatement studies.

A project of Academy of Natural Sciences, sponsored by Manufacturing Chemists' Association, includes building the river. It will then be allowed to develop naturally.

Study will concentrate on development of various forms of aquatic life. Results, however, are expected to point way to better plans for clearing up polluted rivers and streams.

A sterile bed 150 ft. long and 6 ft. wide already has been dug in Paoli, Pa. Various gradings and clean-rock bases in the bed will simulate actual river conditions on diminished scale.

Navy is building a fire under operators in Wilmington field to force immediate cooperative action on a subsidence program.

Threat of collecting millions in damages from oil men for the sinking Navy installations is only incidental.

That's the interpretation being given to suit filed in Los Angeles Federal Court by Justice Department.

Government asks the court to order operators to come up with repressuring program or shut in field.

Damages are asked if operators fail to act and further sinking ruins naval facilities in the area. No set sum is sought, but Navy's investment in field exceeds $200 million.

Add to Russia's many other goals: Desire to become a major crude oil exporter.

That's conclusion drawn by AEC economist (p. 62). He cites Reds' whopping increases in oil, natural-gas production in last 10 years. Oil climbed from 29 to 98 million tons. Gas from 5 to 20 billion cubic meters.

Boosts are dwarfed by Kremlin's announced plans for expansion in 10 to 15 years. Russians are shooting for 400 million tons of oil, 300 billion cubic meters of gas.

Economist says Russia just might do it. Assuming they do, they couldn't use it all. Reds must have some additional use in mind.

Logical answer: Export of oil to pay for growing imports from West.

Pan American International (Indiana Standard) has made another move in the Eastern Hemisphere.

It acquired half interest in a 46,000-sq.-mile concession in Mozambique held by Gulf. Gulf has had an exploration program under way for years in the Portuguese East Africa area. Several deep wildcats have been drilled. Gulf is continuing as operator.

There are some bright spots in the drilling picture.

One Tulsa contractor reports 14 of its 15 rigs are busy. And the company, drilling on its own lease in western Oklahoma, has contracted the job to another drilling company because it has no rigs available in Oklahoma. A second Tulsa drilling contractor says all 11 of its rigs are busy.

But not all contractors are sharing the same good fortune. A report from Oklahoma City shows that a 23-rig company has 15 rigs "available immediately."

Signs point to busiest drilling period in history for the north country this winter.

Home Oil and McColl Frontenac will start the biggest play yet in northern Alberta as soon as freeze-up time arrives.

Reasons for this play are Swan Hills field, a 130-mile pipeline from Swan Hills to Edmonton, and a scheduled 24-well development program.

Propylene alkylation is on the up-swing. Under pressure for higher octanes, refiners are switching propylene from the

less-desirable polymer to alkylate which is prime blending stock.

The latest move: Completion of an 8,000-bbl. per day propylene alkylate unit by Magnolia at Beaumont. Charging 85% propylene and 15% butylene, the new unit boosts refinery pool octanes 0.6 Research octane number.

Look for more of these units.

Here's another important swing in propylene:

Humble is building a 40-million pound polypropylene plant in Texas (p. 50).

This is the first big breakthrough on polypropylene—though not the first plant. It's the first indication that this entirely different plastic really will get off the ground. Hailed as a large-volume petrochemical with a big potential market, it has properties polyethylene does not have.

Domestic refiners now have enough aromatics capacity to outstrip demand for years. And the trend is for more capacity next year (p. 44).

The BTX market shouldn't go to pot, however. Refiners plan to use the surplus for gasoline blending until demand catches up with supply.

A Journal survey shows refiners' BTX capacity totals 51,000 bbl. per stream day. That's 700 million gallons a year, about 50 million gallons more than the total output last year from refineries and coke ovens combined.

Refiners are going after high octanes with a fine-toothed comb.

Molecular sieves which actually "strain" branched-chain molecules from straight-chained relatives may find commercial use. The isomers are much better performers in today's gasoline.

Look for some interesting developments on this shortly.

Note to refiners: Prepare to use lots of alkylate in your motor fuel to remain competitive.

One East Coast refiner is already using 30-35% alkylate in his premium, leaded blend. Its an expensive component, but its guaranteed not to clatter, ping, knock, thud, or "snort."

Clean-burning fuels promise to get the motorist's dollar in the competitive gasoline market.

Jet-fuel manufacturers are beginning to look around for particular crudes that give low-freeze-point kerosine fractions.

On the whole, there isn't any shortage of these crudes yet. But as new commercial jets begin to come into the picture, these crudes are going to be harder and harder to come by. This is only another of several new yardsticks which refiners are applying to crude value today.

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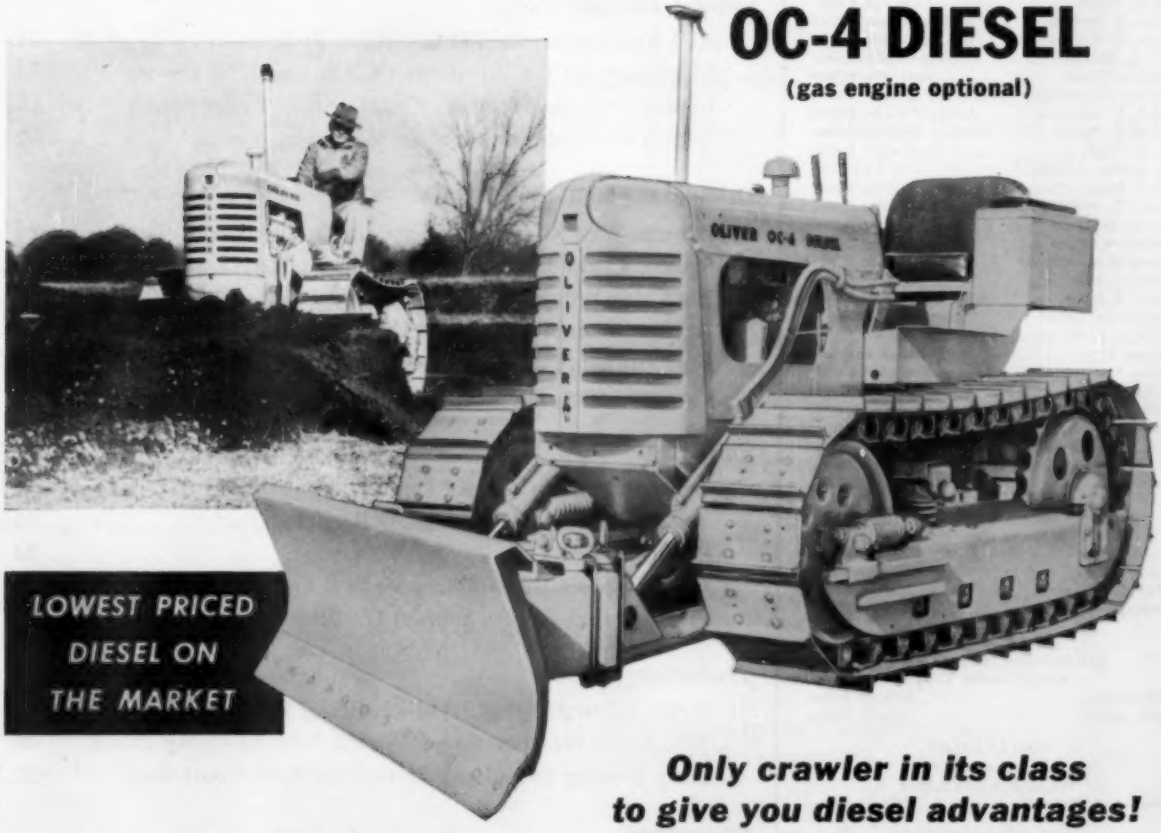

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IN THE NEWS

General Interest:

API Reorganizes Its Public-Affairs Program 41
Machinery Set Up To Merge OCAW and ICW Unions 54
Import Program Weathers Eastern States Court Attack 56
Next Year's Oil Show Will Be Biggest in History 60

Drilling Exploration:

Alberta Well May Grab Canadian Drilling-Depth Record 51
Seismic Crews Use Strange Vehicles in Tidal Flats 55
Big Cable Will Furnish Power for California Offshore Job 59
British Columbia, A Future Oil Giant (Part 4) 74
Four Corners Fated To Be Nation's Hot Spot 131
Geochemistry: The Origin of Oil (Part 5) 132

Pipelining:

Ceremony Marks Formal Conversion of Little Big Inch 43
Texas-Florida Gas Line Finally Ready to Start 46
Pipeline Briefs 54
U. S. Opposes Bill Limiting Federal Gas Regulation 55
Prefabricated Towers Support Gas-Line River Crossing 56

Production:

Texas Allowable Hits 3-Million-Barrel Mark Again 47
Smackover Problem: Stop Pollution Without Going Broke 48
Navy Forcing Subsidence Showdown With Court Suit 52

Processing:

Refiners Move in On Aromatics in Big Way 44
Esso Refinery Uses Computer to Measure Variables 47
Humble Gives Polypropylene Lift in New Plant Project 50
Industry-Built, U. S.-Backed Helium Plants Urged 50
Processing Briefs 50

International:

Russia Considering Major Oil-Exporter Role 62
French, U. S. Firms Seek New Argentine Contracts 65
Getty Sets Low Price for Middle East Crude 66
New Oil-Finding Theory May Be Tested in Puerto Rico 66
Contractors Get Drilling Work in Venezuela 66
Aden Edging New York as World's Top Fueling Center 67
Shell Disappointed, Pulling Out of Dutch New Guiana 67

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TECHNOLOGY–OPERATION

Refining-Processing

Planning Is Vital When Designing Ethylene Storage and Distribution 80

By H. C. Schutt and A. R. Mattioli

Part 2 of a series. The independent producer of ethylene, one which produces olefins from byproducts and sells them on demand, should have a reserve supply equivalent to the normal production during 4 stream days.

How to Determine Chlorides in the Charge to a Catalytic Reformer 94

By Charles Petty and Robert Kung

Serious reformer catalyst damage and production loss can occur if the concentration of organic chlorides in the reformer charge is too high. Here is a method developed especially to analyze for organic chlorides on a fast dependable basis.

Refinery Construction Survey 100

Process Costimating 102

Questions on Technology 103

Pipelining

Using Thin-Wall Pipe in Natural-Gas Pipelines 68

By Robert S. Ryan

More and more natural-gas-pipeline companies are leaning toward the use of thinner-wall pipe because there is considerable material saving possible. It can be used in construction without difficulty and without additional cost.

Pipeline Construction Report 110

Drilling-Production

An Evaluation of Cementing Procedures . . . 70

By E. H. Clarke, Jr., and A. S. Murray

Results of an investigation to evaluate recommended cementing procedures show that a procedure should be carefully set up in each case based on field tests and full utilization of current information.

Fluid Injection for Oil Recovery 86

By George Roberts, Jr., and T. M. Geffen

Fluid-injection methods can increase oil reserves through better recoveries from known reservoirs. The authors here point out the general reservoir characteristics where each fluid-injection method is applicable and what its limits are. Those most likely for a specific field can thus be chosen for studies.

Modern Drilling 107

Exploration

Northeastern British Columbia Offers Lucrative Oil Hunting 74

By G. L. Gray

The concluding installment of a two-part series. The area is underlain by a large thickness of sediments. Many of these have been proved as potential reservoir rocks; a number of others have been little tested by drilling and remain as oil and gas prospects worthy of further investigation.

DEPARTMENTS

They Say 27
Calendar of Events 31
Journally Speaking 37
Editorial 39
Watching Washington 53
Foreign News 62
Refinery Construction Survey . . 100
Process Costimating 102
Questions on Technology 103
Modern Drilling 107
Drilling Contractors 108
Pipeline Construction Report . . 110
New Equipment 122
Trade Literature 125
Equipment Men in the News . . . 127
Exploration Highlights 131
Personals 148
Statistical Summary 152
Drilling Statistics 153
Supply Statistics 154
Refining Statistics 155
Markets 156
Classified Advertising 158
Advertisers' Index 161

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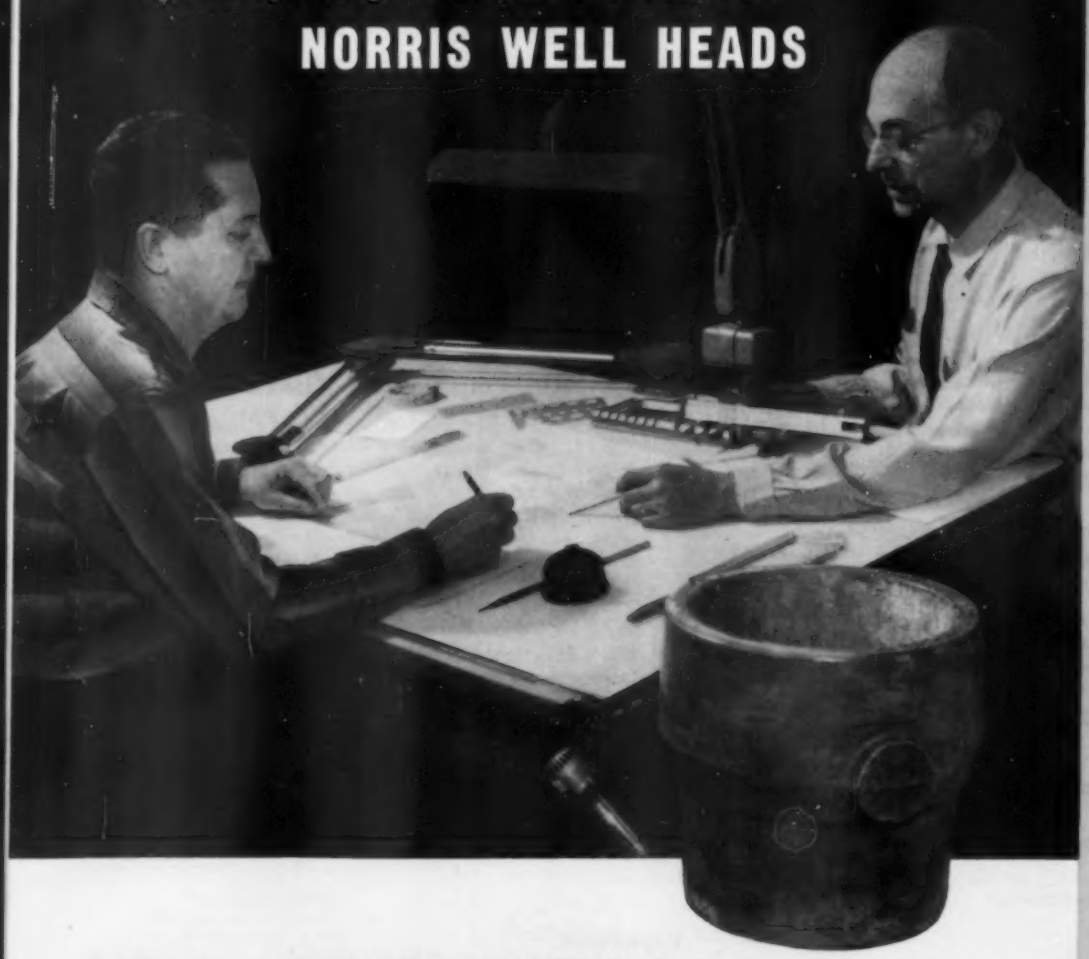

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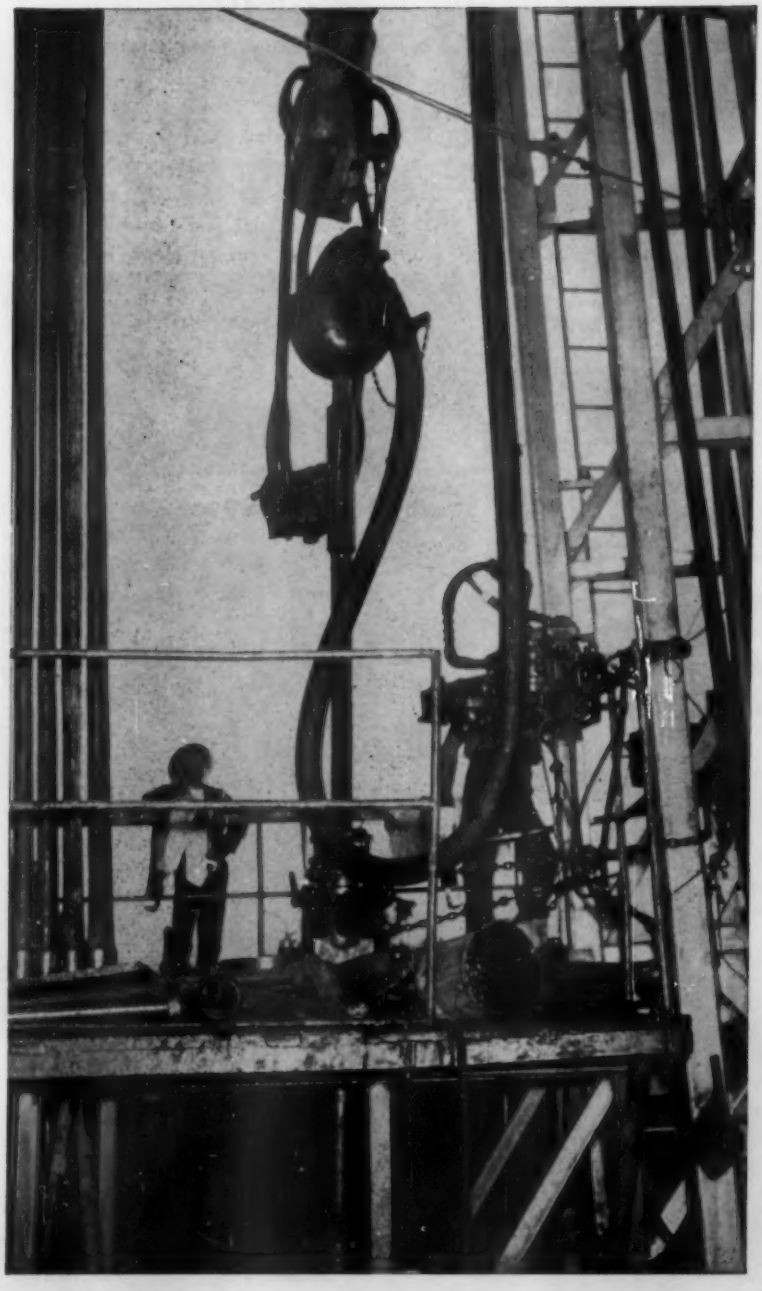

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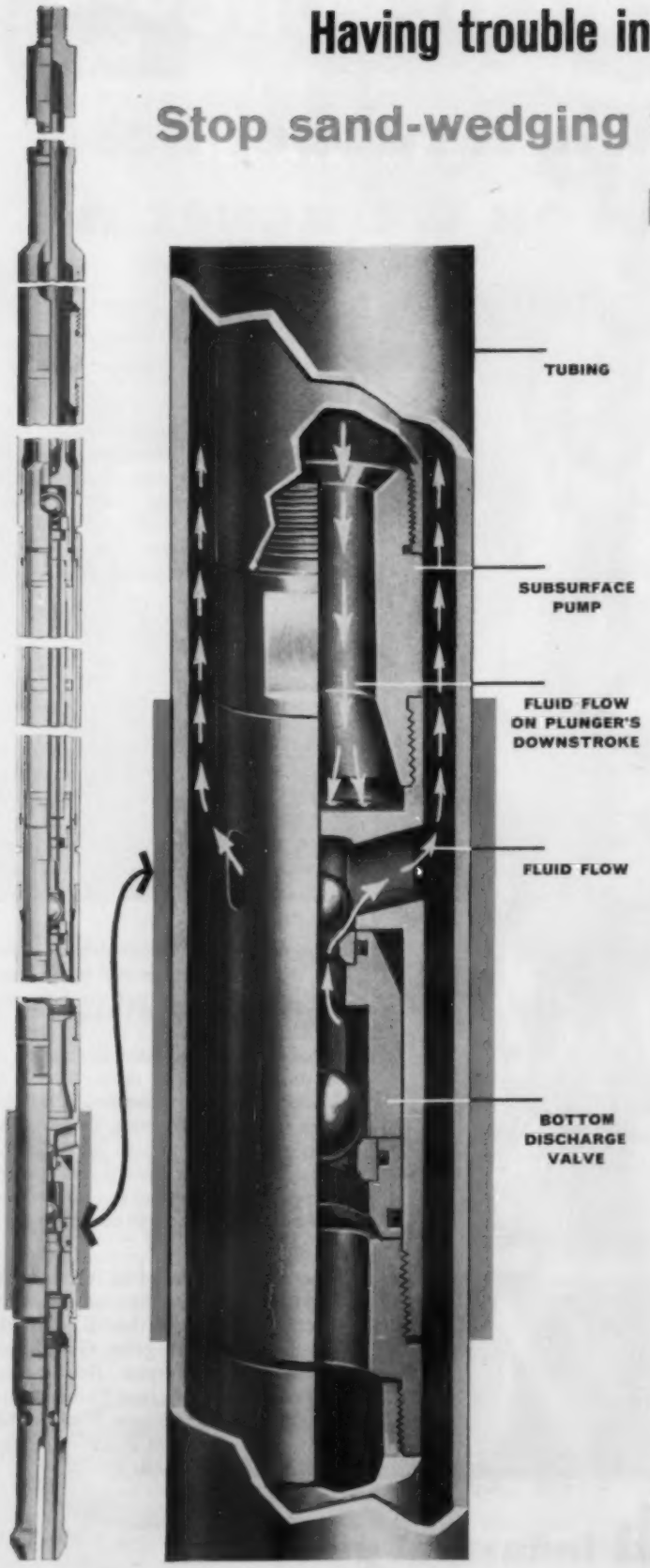

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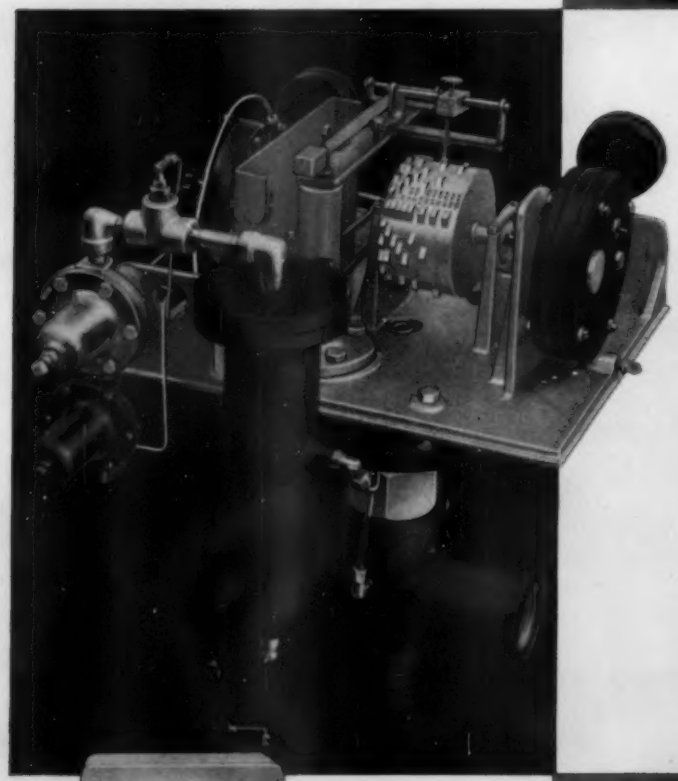

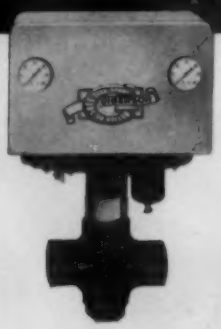

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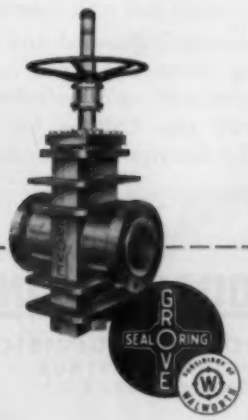

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"We at Zapata are very proud of the performance of our two LeTourneau platforms. Both the Scorpion and the Vinegarroon have rendered exceptionally fine service to the offshore oil industry and we feel they will continue to do so for some time to come."

The Scorpion has demonstrated its mobility by completing a move from one location to another in less than eight hours—including a two hour tow.

The seaworthiness and ease of handling of the Scorpion were demonstrated recently when a single tug towed it from Galveston to Cay Sal Bank, Bahama Islands,—a distance of over 1000 miles.

The Vinegarroon, too, has proved itself under adverse conditions. In June, 1957, it withstood the full force of the destructive hurricane Audrey. Although the anemometer of the platform registered winds in excess of 100 mph before it was broken, the Vinegarroon was the first mobile offshore platform in the area to resume full scale operations.

LeTourneau platforms are custom engineered and built for a wide range of operating conditions. If you have a situation requiring a new platform we'd welcome the opportunity to discuss it with you. Call us for additional information, or write for descriptive literature. No obligation, of course.

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LE TOURNEAU EQUIPMENT

R.G. LETOURNEAU INC
MARINE PRODUCTS DIVISION
2868 SOUTH MACARTHUR
LONGVIEW, TEXAS

M113

Can you afford to miss the pay?

HOMCO Directional Drilling keeps you "on target" all the way down.

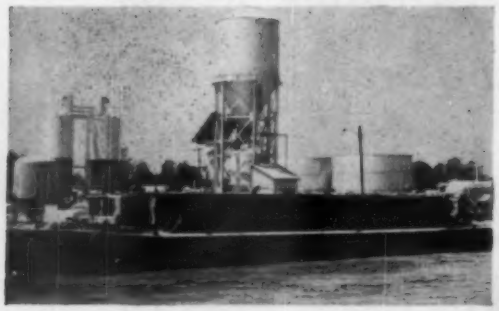
HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY
HOUSTON, TEXAS

THE WORLD'S LARGEST INDEPENDENT ROTARY OILFIELD SUPPLY AND SERVICE ORGANIZATION

RESEARCH • ENGINEERING
DEVELOPING • MANUFACTURING

DIRECTIONAL DRILLING • FISHING & CUTTING • ELECTRICAL WELL SERVICES • OILFIELD SUPPLIES • EXPORT TOOLS & SERVICE

WE HELP ALL KINDS OF OIL MEN



The men who supply the rig, the men who service it, the men who keep it running are all oil men. They are all in the same business, and they are all a necessary part of it. The Oil and Gas Department at The National Bank of Commerce of Houston has the experience and the know-how to help each kind of oil man.

The Commerce can help you because it knows what it's talking about, and, even more important from your point of view, it knows what *you're* talking about. If you are planning to drill, if you are planning to extend needed services, if you are in the oil business, you'll find that The National Bank of Commerce will help you all the way.

E. O. Buck, *senior vice president, Oil and Gas Department.*

THE NATIONAL BANK OF

COMMERCE

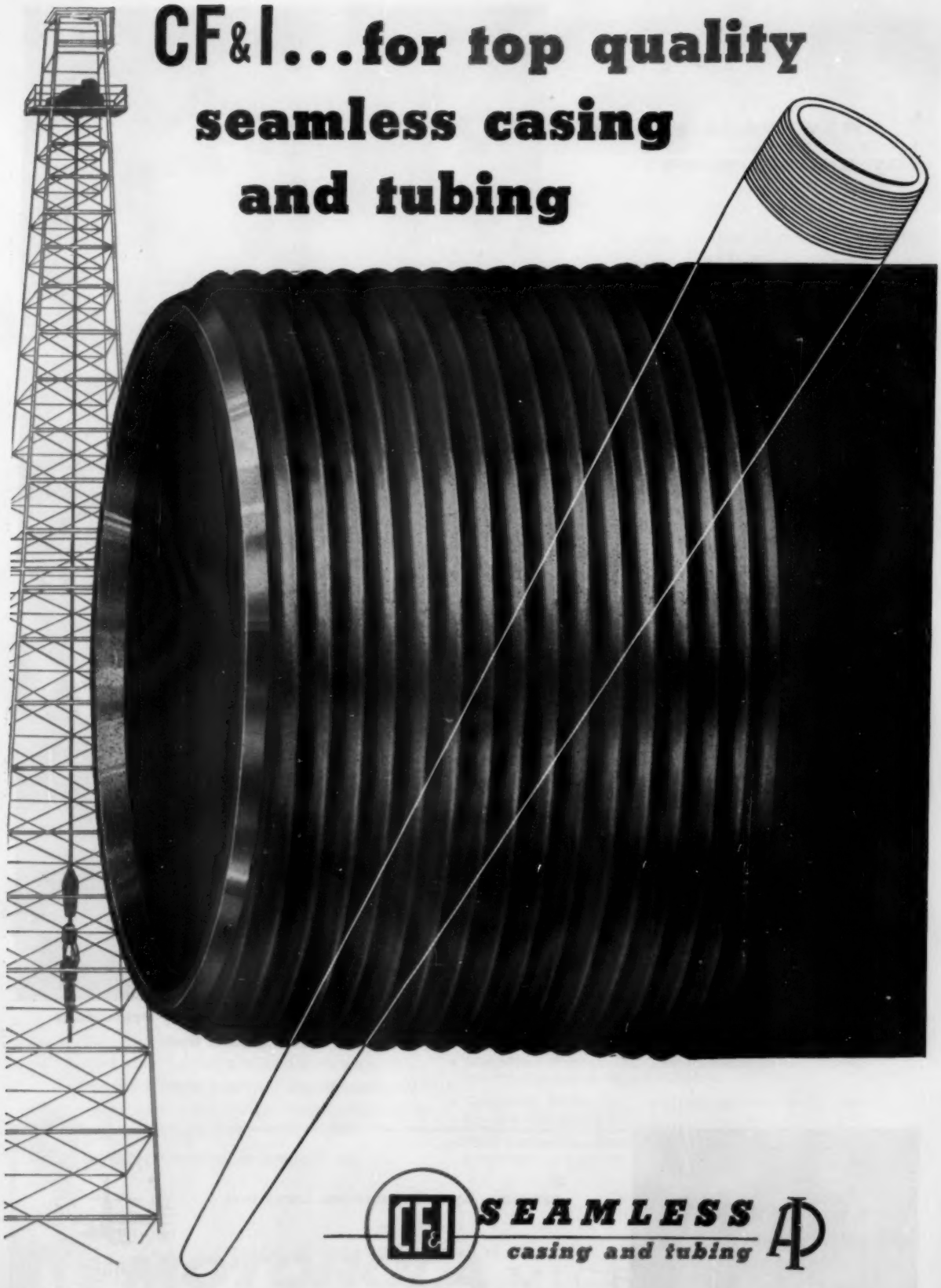
OF HOUSTON

GULF BUILDING • MAIN AT RUSK • HOUSTON

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Facilities of the Oil and Gas Department of The National Bank of Commerce of Houston are available in Wyoming, Nebraska, Colorado, New Mexico, Louisiana, Mississippi, and Texas.

CF&I...for top quality seamless casing and tubing



SEAMLESS
casing and tubing

THE COLORADO FUEL AND IRON CORPORATION • DENVER, COLORADO

"...way made easier by supply stores"

"Since the modern oil industry began at Spindletop 57 years ago, many people and groups have contributed to the notable achievements this industry has made.

"The equipment supply industry is one group which too frequently does not receive recognition for its important role.

"The way of drilling contractors through the years has been made easier by the existence of supply stores.

"These people, their inventory, their many services—regardless of the time or the locale—have given many contractors the stimulus needed to keep up a very gruelling pace.

"The supply store is a much needed warehouse, a banker, a consultant, a friend, and a major factor which has kept the oil industry aggressive and healthy.

"None of us can forget that the future success of the oil industry certainly will depend on a continuation of combined effort on the part of contractors, producers, suppliers, manufacturers and service companies."

Mr. A. W. "Tommy" Thompson, President
A. W. Thompson, Inc.
Past President, A.A.O.D.C.
Past Vice-President, API Division of Production

P.E.S.A.*

* PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

MR-20 MOTOROLA MICROWAVE

Here is microwave at its finest—Motorola-engineered to give you the greatest dollar return in communications flexibility, long-life service and all-weather dependability. Literally millions of orders and instructions by voice, printed message and control signals are carried by Motorola Microwave every day. Point-to-point operation spans city streets, rivers, plains and mountains to speed this information on its way at the lowest per-mile operating and maintenance costs.

Simple, "building-block" components—Motorola MR-20 and associated multiplex equipment—can be fitted to your communication need to provide for any combination of voice, control and data transmission, including 2-way radio operation. Let Motorola Microwave bring the full efficiency and the money-saving opportunities of just-right communications to your operations.

Send for illustrated Brochure 1188.

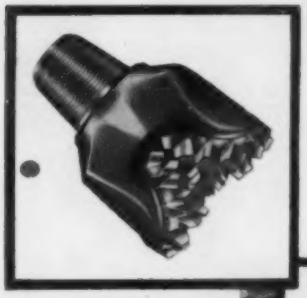
MR-20 Microwave RF equipment . . . even more simple and reliable for maximum dollar value

- **Automatic Switchover-Switchback** . . . provision available for bi-lateral switching where desired.
- **"Hot" Standby** . . . enables switchover to pre-heated unit in less than one second.
- **Simplified Waveguide** . . . allows additional RF channels to be multiplexed to common antenna.
- **Frequency Diversity** . . . provides maximum circuit continuity in 5925-6425 MC band.
- **Plus outstanding Motorola developments for 6000 MC operation** . . . explained in detail in Brochure 1188.

MOTOROLA MICROWAVE

Motorola Communications & Electronics, Inc., A Subsidiary of Motorola Inc., 4501 Augusta Blvd., Chicago 51, Illinois

Bits...



Beans...

Barges...

the oil industry buys "world wide" from Mid-Continent

Rock bits . . . flow beans . . . a complete drilling barge . . . these are but a few of the thousands of items the world-wide oil industry buys from Mid-Continent Supply Company. With field stores and supply points in active oil areas throughout the world, Mid-Continent maintains in-the-field inventories of supplies and equipment . . . your assurance of sure service, sure supply.

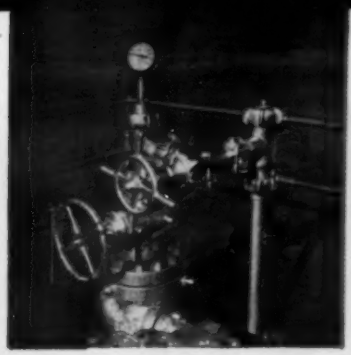
Mid-Continent furnished this turnkey drilling barge for operation on the Louisiana Gulf Coast.

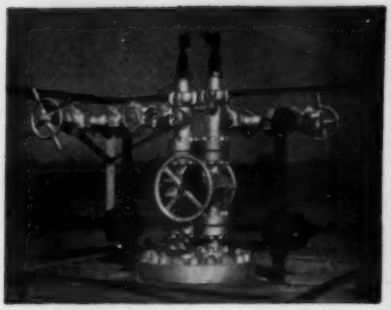
MID-CONTINENT SUPPLY CO.

MID-CONTINENT BUILDING • FORT WORTH, TEXAS

Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY





Nice thing about UNIBOLT Flow Manifolds . . .

you buy only what your well needs, and no more

Since well conditions and completion methods differ widely, no one Christmas tree flow control of the "fixed design" type can possibly serve all wells efficiently. Not so with UNIBOLT Flow Manifolds, the components of which may be readily arranged in any design to exactly fit well requirements.

These flexible Flow Manifolds, composed of standard UNIBOLT Tees, Crosses, Adjustable Wing Valves or Chokes, can be combined in a dozen different ways. Thus, you buy exactly what is needed for a given well.

And the entire manifold may be salvaged as a unit or in separate parts for later use in other manifolds.

From the lightest screwed manifold to the heaviest high-pressure assemblies and corrosion-resistant steel, UNIBOLT Flow Manifolds can be tailored to your needs. You save steel and, at the same time, you hold capital investment to a minimum.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

NOW

ROILINE ENGINES (formerly LE ROI) ARE BUILT BY WAUKESHA.....

3-Cylinder H-540 ROILINE Unit—to 163 hp

V-12 L-4000 ROILINE Engine—to 685 hp

THESE FORMER LE ROI MODELS BECOME WAUKESHA ROILINE ENGINES

Model	Bore and Stroke	No. of Cyls.	Disp. Cu. In.	Max. Torque Lb./Ft. @ RPM	Brake Horsepower at Engine Speeds Indicated 600	800	1000	1200	1400	1600	1800	2000	2200	2400
H540	4½ x 4¼	8	540	454.... 900		68	87	105	122	138	151	164	173	178
H844	5¼ x 4½	8	844	671....1300		113	145	177	205	231	255	274	290	299
F1500	6⅜ x 7	6	1503	1165.... 650	134	176	214	230						
H2000	6¾ x 7	8	2004	1590.... 650	180	240	280	300						
L3000	6⅜ x 7	12	3006	2420.... 650	275	360	435	460						
L3460	7¼ x 7	12	3468	2750.... 900	305	416	527	608	635 @ 1350 RPM					
L4000	7.54 x 7.5	12	4000	3110.... 900	345	471	595	685						

These are engine ratings on LP Gas . . . send for Power Chart with ratings for engines and complete power units operating on natural gas, LP Gas, and gasoline.

WAUKESHA MOTOR COMPANY

Waukesha MOTOR

.... under famous Waukesha Quality Control

ROILINE ENGINES
(formerly Le Roi)

THE ADDITION of these well-known gas and gasoline engines to the Waukesha line... produced by Waukesha engine-builders and sold through the former Le Roi engine distributors... is of great importance to all users of internal combustion engine power.

The principal models of Le Roi gas and gasoline engines, formerly built by the Le Roi Division of the Westinghouse Airbrake Company, have been sold to the Waukesha Motor Company. The engines listed on the opposite page will be known as Waukesha "ROILINE" engines, and be built as bare engines, complete power units, and with components and accessories for special services.

Le Roi engines are widely used in the oil industry, and in various types of cotton ginning, compressor, generator, and pumping installations. They have been well-known in these fields and in other internal combustion engine applications for many years.

Waukesha has all rights to the manufacture and sale of these former Le Roi engine models and the service parts, patterns, and designs. Waukesha will produce the V-8 models H-540 and H-844 high speed transport and industrial engines in the Waukesha plant. The remainder of the engine models, including the in-line Six and large V-8 and V-12 engines, will be manufactured in Waukesha's Climax Division plant at Clinton, Iowa. ROILINE engines, parts, and service will be available in all sections of the country to owners, operators, and purchasers of these fine engines, through the ROILINE distributor organization. OEM accounts normally serviced directly by the manufacturer will be handled through the Waukesha headquarters sales office.

This expansion of Waukesha's production will enable Waukesha to manufacture and supply internal combustion engine power for any requirement from 6 to 1200 horsepower in all normal speed ranges and for use with all standard fuels.

• *The trade mark LE ROI is used under license from Westinghouse Airbrake Co., the trade mark owner.*

383

SEE YOUR ROILINE DISTRIBUTOR

ARIZONA
Casa Grande
Engine Service Company

ARKANSAS
Paragould
Wonder State Manufacturing Co.

CALIFORNIA
Long Beach
Engine & Equipment Company

ILLINOIS
Centralia
John Nickell Company

LOUISIANA
Shreveport
Ingersoll Corporation

OHIO
Columbus
Cantwell Machinery Company

OKLAHOMA
Chickasha
Chickasha Gin & Mill Supply
Oklahoma City
Carson Machine & Supply Co.

PENNSYLVANIA
Pittsburgh
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TEXAS
Houston
Southern Engine & Pump Co.
Lubbock
Farmers Supply Company
Odessa
General Machine & Supply Co.
Wichita Falls
Nortex Engine & Equipment Co.

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WYOMING
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Waukesha, Wisconsin • New York • Tulsa • Los Angeles

Tough valve buyers appreciate this kind of...

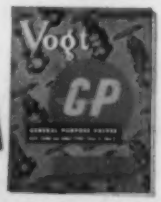
Toughness

*HAYNES STELLITE

Here's why:—They know that to foil those troublesome valve "termites"—erosion, corrosion, and galling—requires built-in toughness which only seats faced with hard facing alloys AND hardened wedges can provide. Yes, it takes BOTH to do a real job and GP Valves provide both at no extra cost!

Vogt GP Valves feature the toughest and, since they are precision finished, the smoothest seating surfaces obtainable anywhere. That's why they are setting new standards of performance—longer, drop-tight service with minimum, low cost maintenance—in petroleum refineries, chemical plants, power plants and other industries. Available in a complete range of sizes from ¼" to 2" and rated 800 pounds at 850° F. and 2000 pounds at 100° F.

Advt. No. 5 in a series describing the features of Vogt GP Valves.



Write for Your FREE COPY of Supplement No. 1 to Catalog F-9. Dept. 24A-FO.

HENRY VOGT MACHINE CO.
P. O. Box 1918—Louisville 1, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati.

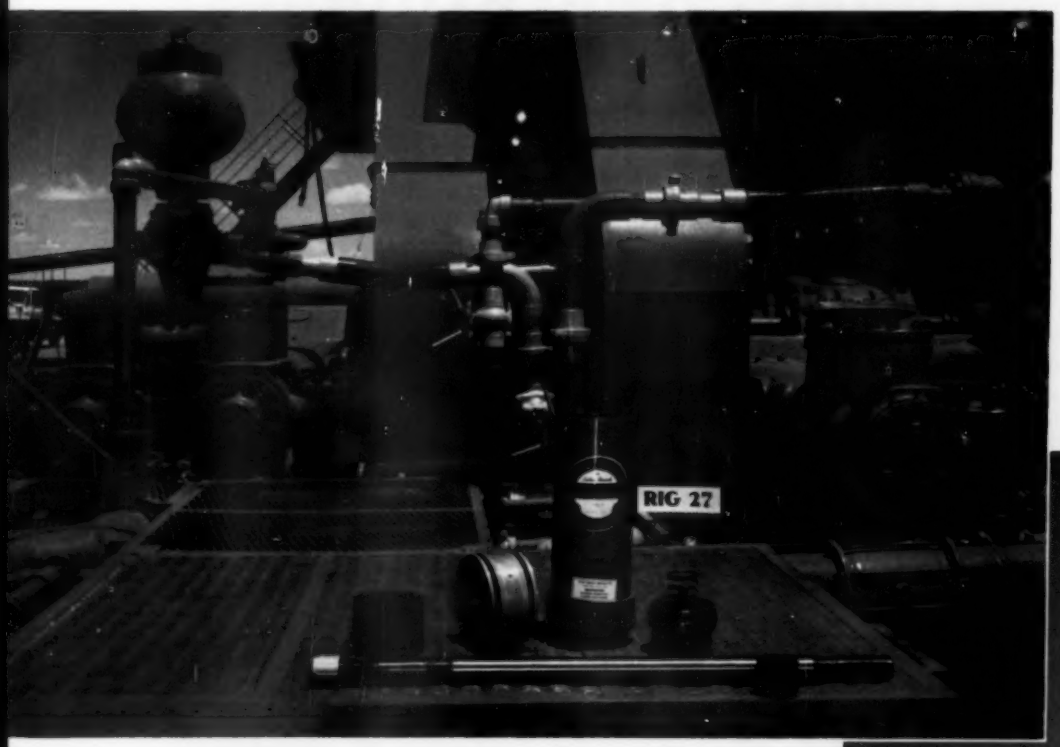
Vogt GENERAL GP PURPOSE Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

HAYNES STELLITE—Trade-mark of Union Carbide and Carbon Corporation

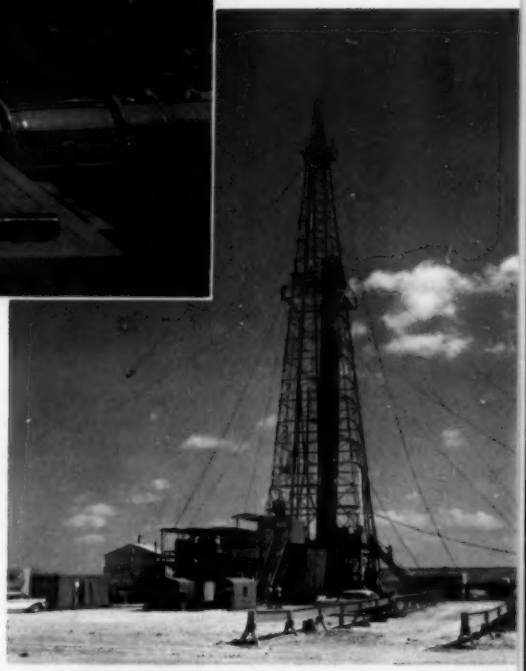
How MISSION pump parts helped "drill" the world's deepest well before it was even spudded!



Long before the Phillips Petroleum Company's 1-EE University started drilling, Mission research engineers had already designed and tested, in Mission's own mud pump laboratory, the vital pump parts that helped carry this well to its new world's record.

Under simulated extreme conditions that could be anticipated in drilling to 25,000 feet, the Mission Rods, Liners, Valves, Pistons, Liner and Gland Packings that figured in this remarkable drilling achievement passed all tests like the champions they are.

The drilling of the Phillips Petroleum Company's 1-EE University is not only a tribute to the pioneering spirit of the Phillips Petroleum Company, it emphasizes again the foresight and ingenuity of the oil tool manufacturers and technical services fraternity who are partners in petroleum progress.



Phillips Petroleum Company's 1-EE University in Pecos County, Texas.

Nothing but the finest will bear the name of **MISSION** MANUFACTURING CO.

PESA

MISSION MANUFACTURING CO., P. O. Box 4209, Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
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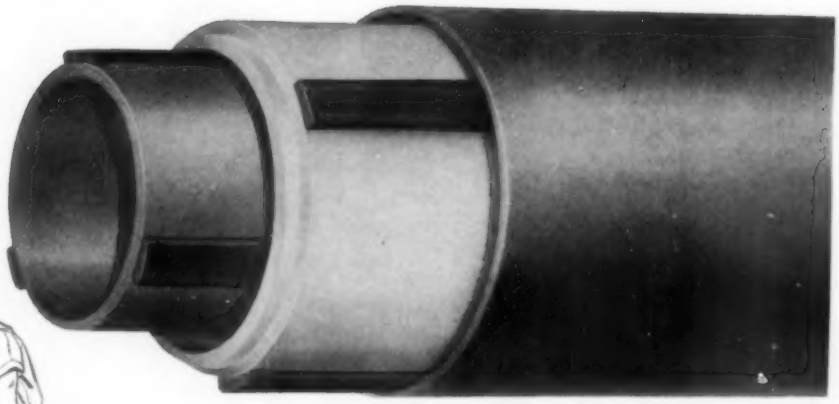
PISTONS • PISTON RODS • SLIPS • GLAND PACKINGS • LINERS • LINER PACKING
PUMP VALVES AND SEATS • SWABS • VALVES • HAMMERDRILS • CENTRIFUGAL PUMPS

STOPS *Sand Cutting* IN DUAL COMPLETIONS!



In the Impenecap Joint, the ceramic sleeve floats on splines of rubber between two steel surfaces. It is fully protected against damage during and after run-in.

Abrasive gas-jetting opposite the perforations in multiple completion strings has cost the industry BIG money in lost production, materials and labor. Previous attempts to slow this action have been relatively ineffective.

Tubing Life Increased 25 Times

Now you can virtually *eliminate* tubing replacement due to sand cutting. The new Impenecap Joint gives up to 25 times longer tubing life under the most extreme conditions than is provided by other abrasion-resistant coatings now in use.

New Material—New Design

Harder than corundum, topaz or sapphire, the new Impenecap silica-base ceramic material is extremely dense and two points harder (Mohs' Scale) than other ceramic materials available for this use. As applied, the Impenecap ceramic is fully protected against breakage during and after running in.

Standard Lengths for Immediate Delivery

The Impenecap Joint is manufactured in standard 30′ lengths, stocked in 2⅜″ nominal tubing size, for immediate shipment in the USA and abroad. Other tubing sizes are available on order. Special box and pin joints can be furnished to make up multiple-joint sections.

GET ALL THE FACTS . . . WRITE FOR BULLETIN 25-1

Plasticap
PLASTIC APPLICATORS INC.

PLASTIC APPLICATORS, INC.

HOME OFFICE AND PLANT:
P. O. Box 7631, Houston 7, Texas. Phone UN 9-3611.
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TEXAS: Houston, Corpus Christi, Dallas, Midland, Odessa.
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NEW MEXICO: Hobbs.
BRITISH WEST INDIES: H. J. Gransaull &, Co., Ltd., San Fernando, Trinidad, B.W.I.

Here's the newest development in wire rope—

USS FIBRESEAL

It's TIGER BRAND of course!

This new wire rope was developed to meet the need for longer life in sand lines, swabbing lines, coring lines and cable tool drilling lines. It has a plastic impregnated fiber core which combines the good deterioration resisting properties of a plastic core with the excellent strand supporting characteristics of a fiber core.

The plastic protects the fiber and prevents absorption of acids and other hole fluids. Consequently, the rope retains its structural balance even when used in drilling or swabbing acidized or sour wells.

One of these new Fibreseal ropes was used in cleaning out 23 wells. Twelve of the wells were acidized and very corrosive. After four months of service, the rope was checked for deterioration. The core was found to be in good condition, having resisted all well fluids without trouble. The user was extremely well pleased with the extra service life he obtained, and the behavior of the line has been very satisfactory.

Send the coupon for the complete story on USS Tiger Brand Fibreseal Wire Rope.

USS and Tiger Brand are registered trademarks

American Steel & Wire
Rockefeller Building
Cleveland 13, Ohio

Please send me your free folder on Tiger Brand Fibreseal Wire Rope.

Name.....

Company.....

Address.....

City.....**State**.....

American Steel & Wire Division of USS **United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, Distributors Abroad

No embrittlement! Lowest cost! ASME Code approved!

In the subzero operating range . . .
Specify Alcoa Aluminum equipment and piping

The flow chart details a tonnage oxygen plant now in actual operation where process temperatures average below minus 300° F. Notice that virtually all of the equipment and process piping are ALCOA® Aluminum. There's a good reason: aluminum is the lowest cost metal able to perform satisfactorily at low temperatures.

At subzero temperatures, ASME code approved aluminum alloys suitable for welded construction display improved yield and tensile strengths with no reduction in ductility or resistance to shock loading (see graphs). There is no embrittlement!

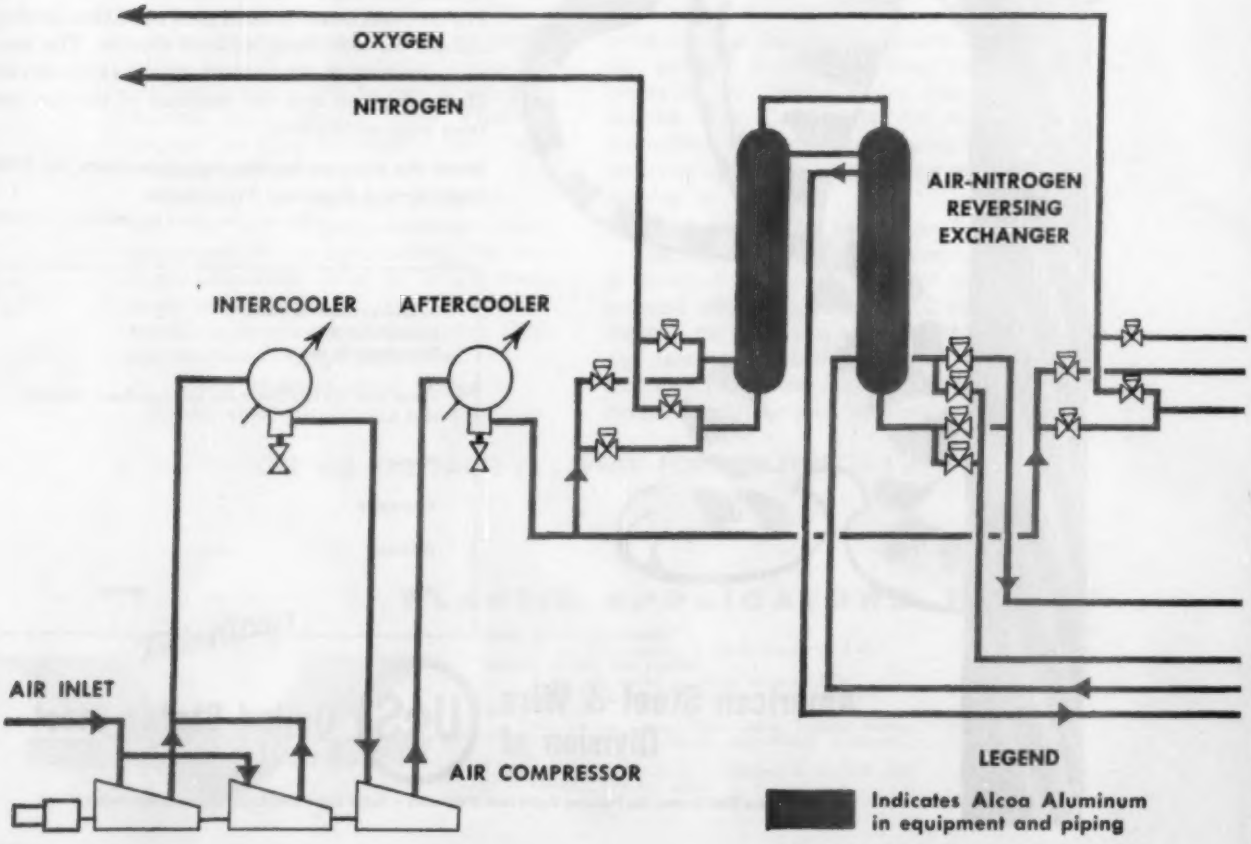
And in these operating temperature ranges, aluminum offers other valuable benefits . . . light weight . . . excellent resistance to corrosion . . . great strength in alloys . . . high thermal conductivity . . . nonmagnetic, nonsparking characteristics . . . nontoxicity . . . and excellent reflectivity. It is highly workable and lends itself readily to a variety of welding or brazing techniques for easy fabrication.

When *you* are looking for a low cost answer to the many problems of satisfactory equipment and piping performance in low temperature operations, *it will pay you to specify Alcoa Aluminum.* ALCOA engineers have worked with aluminum in the process industries for over 30 years. Use their accumulated knowledge to help you find satisfactory answers to *your* process equipment problems. Consult the nearby ALCOA sales office listed in the Yellow Pages of your telephone directory . . . or outline your equipment requirements in a letter to ALUMINUM COMPANY OF AMERICA, 904-H Alcoa Building, Pittsburgh 19, Pa.

"ALCOA THEATRE"
Exciting Adventure
ALTERNATE MONDAY EVENINGS

ALCOA ALUMINUM

THIS FREE BOOK is filled with detailed data on the behavior of aluminum in the process industries . . . the result of more than 30 years of Alcoa engineering experience with aluminum in a variety of applications in nearly every temperature range. Use it as your guide to trouble-free, corrosion-free process equipment and piping. Write today for *Process Industries Applications of Alcoa Aluminum.*



LOW TEMPERATURE PROPERTIES OF ALCOA ALLOY 5154-0

Alcoa Aluminum actually increases in strength with no loss in ductility as temperatures drop to minus 320°F and below. Alloy 5154-0, for example, improves 50% in tensile strength, over 13% in yield strength and approximately 60% in elongation.

Photograph shows installation of Alcoa Aluminum equipment and piping in oxygen plant detailed in flow diagram. Harp-type heat exchangers (left) are dip-brazed assemblies with thousands of fins for best heat transfer.

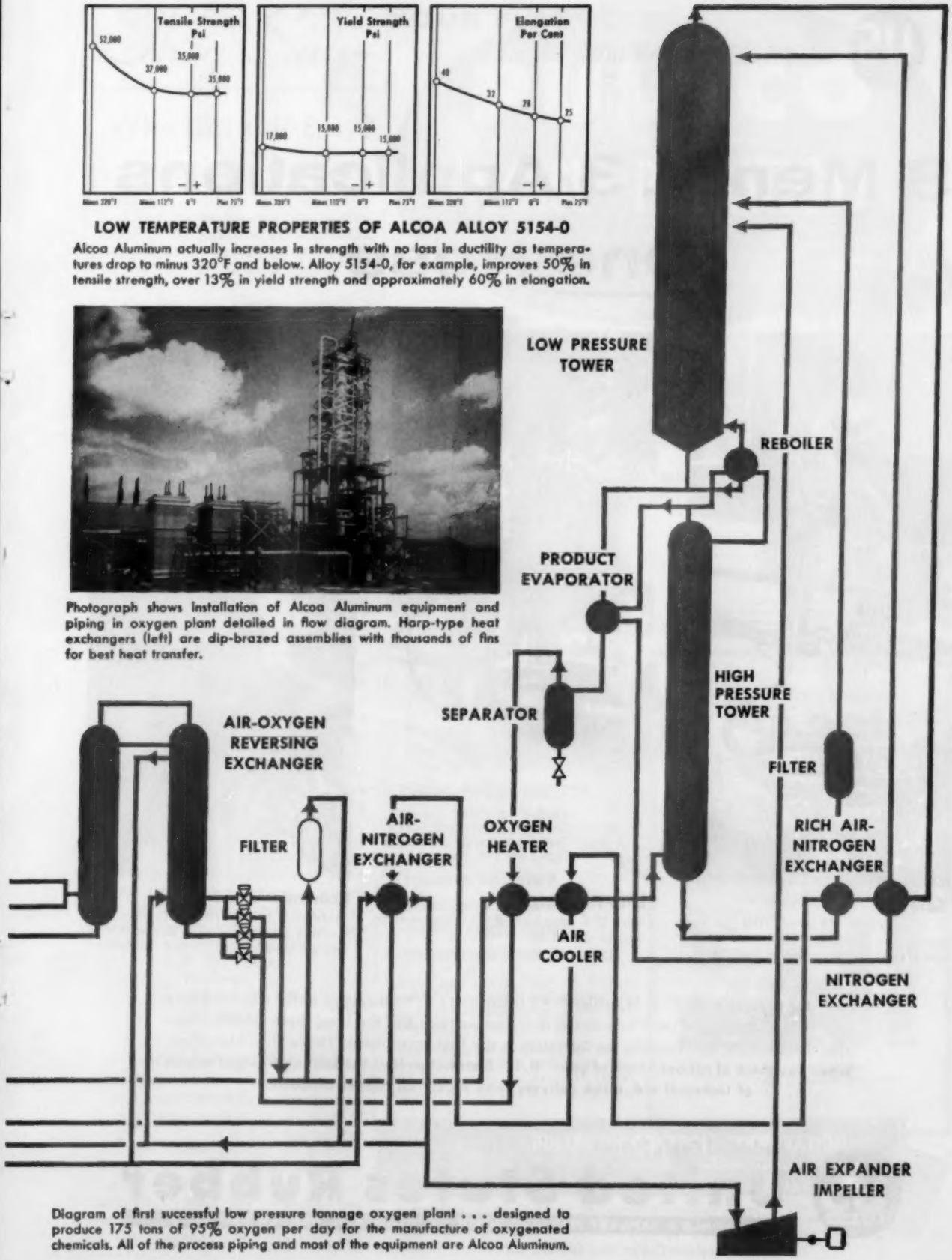


Diagram of first successful low pressure tonnage oxygen plant . . . designed to produce 175 tons of 95% oxygen per day for the manufacture of oxygenated chemicals. All of the process piping and most of the equipment are Alcoa Aluminum.

MATCHLESS #5 STEAM HOSE

3 Men . . . 3 Applications
One Hose

Safety
U. S. Matchless #5 Steam Hose has been used at a Phillips Petroleum refinery* since 1930, for thawing and firefighting.

Easy Handling
Here U. S. Matchless #5 is being used to remove spilled oil.

Economy
Warehouse boss at Phillips Petroleum inspecting a length of U. S. Rubber Matchless #5 Steam Hose.

Men like to work with U. S. Matchless® #5 because it's so lightweight, so flexible. Ordinary hose is hard to handle, can't take much dragging around. But the hose that's readily available, lasts longer, and satisfies the operators is the best investment. That's U. S. Matchless.
When you think of rubber, think of your "U. S." Distributor. He's the best on-the-spot source of technical aid, quick delivery, and industrial rubber products.

*Ohmulgee, Okla.

Mechanical Goods Division
United States Rubber
WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS
Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

They Say—

Who Got Off Easy?

. . . a damaging headline

Dear Sir:

I just cannot get over the implications of the Journal's headline (OGJ, Aug. 4, cover) that the oil industry got off so easy at this congressional session.

Certainly this headline conveys a very definite impression that the industry escaped restrictive legislation imposed upon other economic groups in our country. I do not believe that this can be substantiated. I am afraid that the demagogues in Congress who have long made the oil industry a whipping boy will gleefully seize upon this headline as a lever for further assaults upon the industry.

Sam. T. Mallison
Pittsburgh

. . . entirely uncalled for

Dear Sir:

It is with regret that I noticed the headline of your edition of August 4 reading "Oil is Getting Off Easy in Congress."

This undoubtedly was a slip of the tongue on the part of some person in your organization, as, frankly, I feel that the oil and gas industry bore a considerable brunt of the proceedings in Congress during this present year.

On top of that, there are a number of suits pending against certain major companies throughout the country by the Department of Justice.

I am just as sure as I am sitting here that some members of Congress will seize on this headline and use it in the forthcoming sessions as a banner in their tirade against our industry. In my humble opinion this headline was entirely uncalled for.

S. M. Vockel
President
Waverly Oil Works Co.
Pittsburgh.

. . . grist for pettifog mill

Dear Sir:

It is most unfortunate that through a misleading headline in its issue of August 4, The Oil & Gas Journal has provided ammunition for the political demagogues who constantly pillory the oil industry as a gigantic and unscrupulous monopoly without any sense of social responsibility.

The headline, "Oil Is Getting Off

YOUR FIRST CHOICE —

PULSCO*

NOISE and PULSATION CONTROL DEVICES

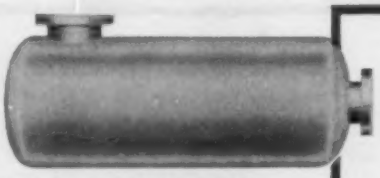
Quiet that noisy blower with a . . .

PULSCO SUCTION MUTE®

FOR ALL TYPES OF CENTRIFUGAL BLOWERS, RECIPROCATING COMPRESSORS, ROTARY AND AXIAL FLOW COMPRESSORS.

A. MUTES SUCTION NOISES
B. IMPROVES BLOWER PERFORMANCE WITH LOW PRESSURE LOSS
C. PROVIDES RAIN HOOD PROTECTION
D. INCORPORATES ENTRANCE SCREENS OR FILTERS

Installation of PULSCO Suction Mute on Centrifugal Blower at a Major Oil Company Refinery.



SUBDUES PIPELINE VIBRATION.

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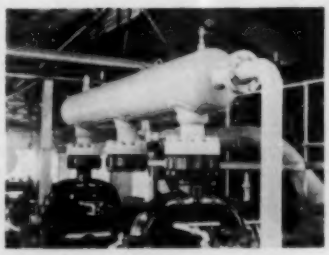

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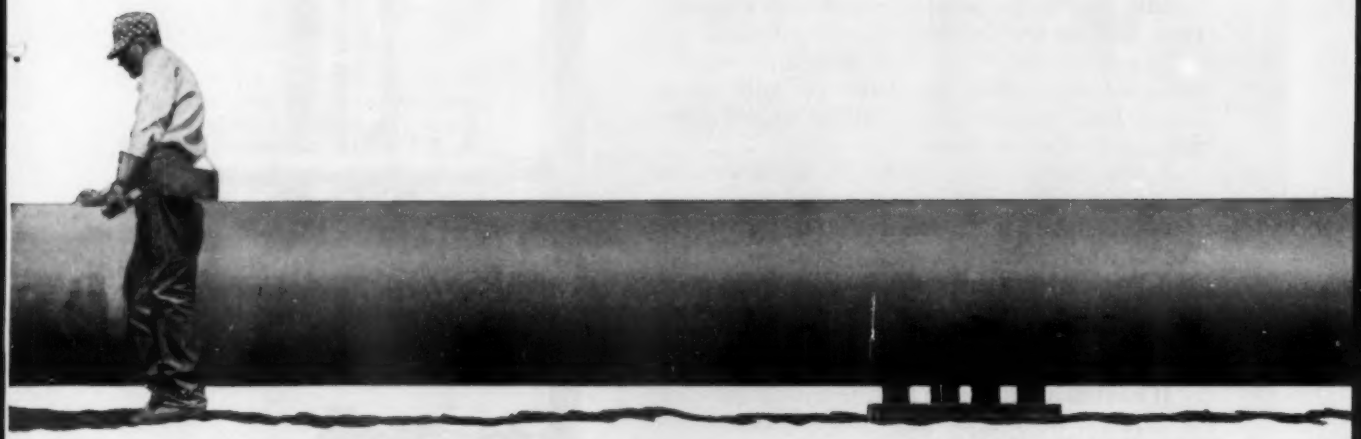
LINE PIPE to 42 in.



BETHLEHEM STEEL LINE PIPE—now produced to 42 inches OD—is manufactured to the specifications shown below.

	SIZES (in., OD)	WALL THICKNESSES (in.)	LENGTHS	SPECIFICATIONS
HYDRAULICALLY EXPANDED ELECTRIC FUSION-WELD (submerged arc)	22 and 24 26 through 36 36 through 42①	¼ to .0438 incl. ¼ to ⅜ incl.① ¼ to ¾ incl.①	40-ft②	API 5LX, Grades X42, X46, X52 & X56①
ELECTRIC RESISTANCE-WELD	5 (nom) to 16	API	to 60-ft	API 5L, Grades A & B API 5LX, Grades X42 & X46
CONTINUOUS BUTT-WELD	½ to 4 (nom)	API	SRL 24 to 26-ft DRL to 50-ft	API 5L, ASTM 120; ASTM 53
COMPRESSOR STATION PIPE	in diameters, thicknesses, and lengths as required; fabricated from as-rolled, high-strength Mayari R steel; made in accordance with Sec. 8 of ASA B 31. 21.8—1955.			

① For sizes, thicknesses, and physical properties exceeding present API 5LX specifications, official API monogram cannot be applied.
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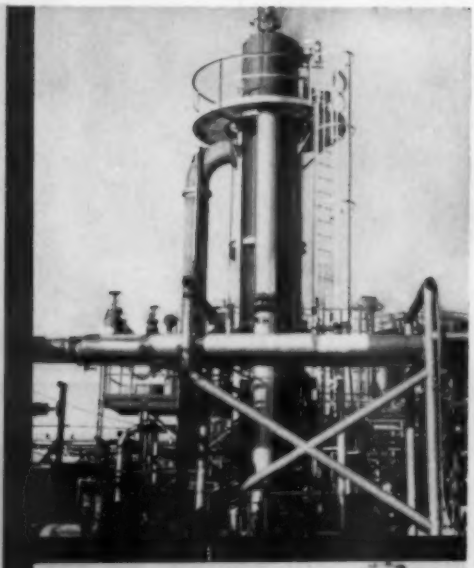

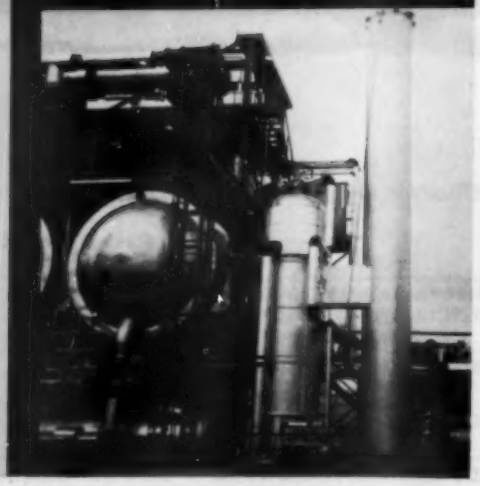

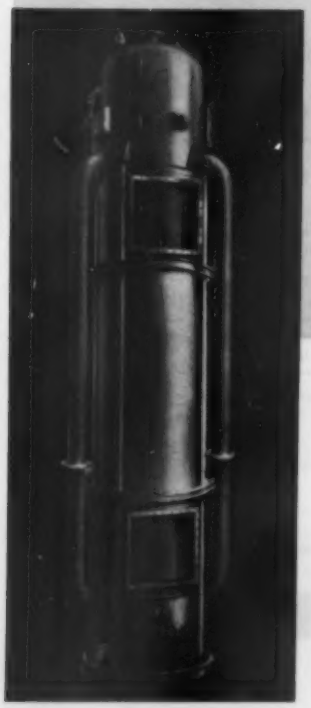

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Easy in Congress," is grist for the mill of these pettifoggers. They can, and undoubtedly will, hold it up as proof of their irresponsible assertions that, through some sinister influence, the oil industry enjoys benefits and privileges which are denied to other economic groups.

It is regrettable that the implication that the oil industry has some special immunity in Congress should come from any source, particularly from a publication that is generally recognized as reflecting the views of the industry.

Walter S. Hallanan
President
Plymouth Oil Co.
Pittsburgh

FPC story well presented

Dear Sir:

Thank you for the excellent presentation which you gave to my paper ("Give FPC Credit for Trying") on the Federal Power Commission in your issue of July 28 (p. 156).

The editorial revisions which you made were all improvements on the original text. The illustrations were excellently prepared, and I think their titles invited attention to the essential features of the illustrations. They were an excellent addition to the paper. . .

R. S. Knappen
Mid-Continent Manager
Foster Associates
Tulsa

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

SEPTEMBER

6-7 Coating Society of the Houston Area, coating school, Hanna Construction Co., Houston.

7-12 American Chemical Society, fall meeting, Chicago.

10-12 National Petroleum Association, fifty-sixth annual meeting, Traymore Hotel, Atlantic City, N. J.

10-13 Intermountain Association of Petroleum Geologists, ninth annual field conference, Paradox basin.

14-17 University of Illinois, petroleum marketers management institute, Allerton Park, University of Illinois conference center.

14-19 Instrument Society of America, thirteenth annual instrument-automation conference and exhibit, Convention Hall, Philadelphia.

15-16 Independent Natural Gas Association of America, annual membership meeting, Roosevelt Hotel, New Orleans.

15-16 University of Kansas, Southwest Kansas Center, sixth annual Gas Measurements Institute, Liberal, Kans.

15-17 American Institute of Electrical En-

You can get the "Roustabout 1523" at your favorite supply store!

Why the "Roustabout 1523" is the best all-purpose jack for drillers

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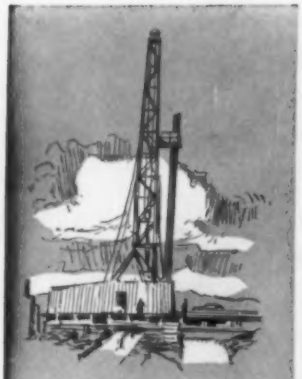
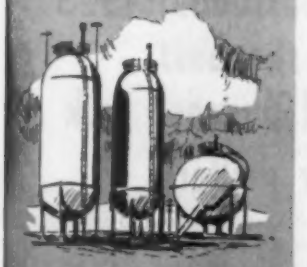


INDUSTRY LOANS

PRODUCTION LOANS



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gineers, fifth electrical conference of the petroleum industry, Baker Hotel, Dallas.

18 Natural Gasoline Association of America, Rocky Mountain regional meeting, Gladstone Hotel, Casper, Wyo.

18-20 Rocky Mountain Association of Geologists, field trip, Maroon basin, registration, Glenwood Springs, Colo.

21-24 American Society of Mechanical Engineers, petroleum division, mechanical engineering conference, Cosmopolitan Hotel, Denver.

22 University of Texas, third semiannual school of gas technology, 6-week term, Conroe, Tex.

22-24 American Institute of Chemical Engineers, national meeting, Hotel Utah, Salt Lake City.

24-25 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

25 Manufacturing Chemists' Association, Texas Chemical Council, chemical industry safety workshop, Shamrock Hilton Hotel, Houston.

25-26 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

25-27 Illinois State Geological Survey, biennial petroleum engineering conference, University of Illinois, Urbana.

29-Oct. 3 Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum, and aircraft engineering display, The Ambassador, Los Angeles.

OCTOBER

1-2 Western Petroleum Refiners Association, third annual stream-pollution and waste-disposal conference, Lassen Hotel, Wichita.

1-3 American Association of Oilwell Drilling Contractors, eighteenth annual meeting, Adolphus and Baker Hotels, Dallas.

3 American Institute of Chemical Engineers, South Texas section, thirteenth annual technical meeting, Moody Center, Galveston, Tex.

5-8 Society of Petroleum Engineers of AIME, fall meeting, Houston.

5-8 National Association of Corrosion Engineers, northeast region, Somerset Hotel, Boston.

7-8 Texas Mid-Continent Oil and Gas Association, annual meeting, Statler-Hilton Hotel, Dallas.

9-10 California Natural Gasoline Association, thirty-third annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

10-12 Tri-State Oil Show, Roberts Municipal Stadium, Evansville, Ind.

12-18 OIL PROGRESS WEEK.

13-15 American Gas Association, annual convention, Atlantic City, N. J.

13-15 American Society of Mechanical Engineers, American Society of Lubricating Engineers, conference on lubrication, Statler Hotel, Los Angeles.

13-16 Society of Exploration Geophysicists, annual meeting, Hotel Gunter, San Antonio, Tex.

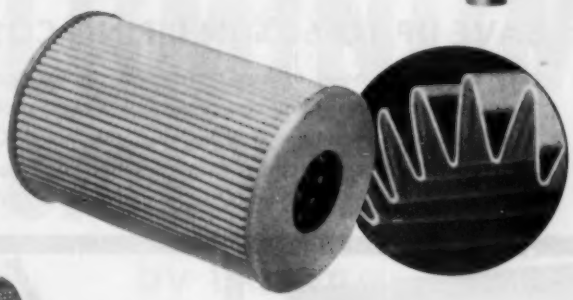
13-17 American Society of Civil Engineers, annual convention, Hotel Statler, New York.

15-16 South Dakota Independent Oil Men's Association, convention, Sheraton-Johnson Hotel, Rapid City.

15-16 University of Kansas, Southwest Kansas Center, sixth annual Gas Measurements Institute, Liberal, Kans.

Lapeer "Burks" filters are available in standard sizes from 15-1500 GPM.

The filter/separator (available from 100 to 1000 GPM) removes emulsified water and microscopic dirt from light petroleum products.



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- Accessories available: air eliminator, differential pressure-gauge assembly, sight glass, automatic drain valve, line shut-off valve.

Water and dirt is the bugaboo when you are pumping petroleum liquids from one place to another in your operation. Proper stripping and filtration is a necessity in order to step up the expected life of plant equipment like pumps, valves, meters and nozzles.

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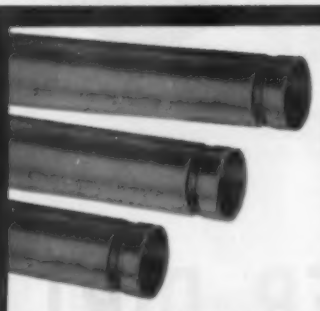

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4. VICTAULIC FULL-FLOW FITTINGS team up with our couplings and lightweight pipe to provide a *complete VIC-EASY system*...cuts costs of installation *and* operation.

For complete information write for Bulletin EE-8.

VICTAULIC COMPANY OF AMERICA
P.O. BOX 509 • Elizabeth, N. J.

15-17 National Association of Corrosion Engineers, north central region, Cincinnati.

16-17 Society of Petroleum Engineers of AIME, Southern California petroleum section, Biltmore Hotel, Los Angeles.

16-18 New Mexico Geological Society, Arizona Geological Society, ninth annual field conference, Black Mesa basin, registration Gallup, N. M., Oct. 15.

16-18 Permian Basin Oil Show, Odessa.

19-21 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Adolphus, Dallas.

20-24 National Association of Corrosion Engineers, south central region, Roosevelt Hotel, New Orleans.

20-24 National Safety Council, forty-sixth National Safety Congress, Conrad Hilton Hotel, Chicago.

22-23 National Association of Corrosion Engineers, western region, corrosion control course, U. S. Grant Hotel, San Diego, Calif.

22-24 Society of Automotive Engineers, national diesel engine meeting, Lord Baltimore Hotel, Baltimore.

22-25 Southwestern Federation of Geological Societies, regional meeting, Mineral Wells, Tex.

23-24 Rocky Mountain Oil and Gas Association, annual fall meeting, Town House Motel, Omaha.

23-24 Western Petroleum Refiners Association, refining technology and industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

26-31 American Institute of Electrical Engineers, general meeting, Pittsburgh.

27-28 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

NOVEMBER

5-6 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-7 American Association of Petroleum Geologists, Pacific section annual meeting, Los Angeles.

6-7 Louisiana Polytechnic Institute, School of Engineering, seventh annual instrumentation conference, Ruston, La.

6-8 Geological Society of America, national convention, St. Louis.

10 Transportation Club of the Petroleum Industry, annual meeting, Bismarck Hotel, Chicago.

10-13 American Petroleum Institute, thirty-eighth annual meeting, Conrad Hilton, Palmer House, and Congress hotels, Chicago.

18-20 Ninth National Conference on Standards, Hotel Roosevelt, New York.

20-21 American Society of Civil Engineers, structural division and Kansas City section, conference on electronic computation, Kansas City.

21 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

30-Dec. 5 American Society of Mechanical Engineers, annual meeting, Statler and Sheraton-McAlpin hotels, New York.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Kansas City.

7-10 American Institute of Chemical Engineers, annual meeting, Netherland Plaza Hotel, Cincinnati.

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Darling gate valves of aluminum alloy offer all of the unique, extended-life features inherent with the Darling fully revolving double disc, parallel seat principle... for performance that assures unmatched economy... and freedom from leakage, trouble and downtime!

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

How's Your Pona?

EVER HEAR of pona? If you're an oil producer you probably haven't —yet. But it's important to you because it affects the price you get for your crude.

If you're a refiner you may or may not have heard the word tossed around a little. But you'll be using it yourself before long because it seems to be coming into the language fast as a handy term for a thing that's a hot subject with all refiners these days.

The reason we know this is that the word landed in the research department of a big producing company the other day, and nobody there knew what it meant. So—naturally—a call was put in to the Oil Man's Bible. And—naturally—our staff had the answer.

Since this column's mission in life (if any) is to dole out nuggets of knowledge in sugar-coated capsules, we feel beholden to spread enlightenment about this pona business.

Pona is a coined word. It is made up of the initials of the words paraffins, olefins, naphthenes, and aromatics. Those things, in case you didn't know, are constituents of crude oil, or, to be a little more exact, are hydrocarbon types separated (or synthesized) in refineries and are darned important in the quality of gasoline.

In recent years—in fact ever since a catalytic reformer became a common working tool in almost every refinery—refiners have been nuts about naphthenes, and aromatics. It seems that these things make the choicest high-octane gasoline.

So you're in the money if you own a cat reformer and have a supply of crude oil that contains few paraffins and olefins but lots of naphthenes and aro—oh, let's just use their initials and call them P, O, N, and A. That's what the refinery lab boys did. And then they discovered that if they ran the letters together they had a pronounceable word, pona, thus saving much vocal effort.

So pona originated as laboratory slang, but we predict that before long it will be in rather common use throughout the industry. Any day now we expect to see some advertising copy writer get hold of it and slap it all over billboards promoting "the gasoline with pona power," or something like that.

Actually, refiners are after only the N and the A parts of pona (shall we say the pona tail?) because they are the *creme de la creme*, the *essence de vie*, the *ne plus ultra* of all the characteristics of crude oil. The P part is what they don't get very excited about.

So when refiners talk about the pona of crude they refer to the total yield of all four of these things in the straightrun naphtha and the relative percentages of each. (We hear on the q.t. that olefins really aren't important because you can't hardly find them in crude oil, but if you disregard the O you can't pronounce the word).

So if your crude has a good pona, brother, you're in like Flynn. But if it's pona-poor, you shoulda stood in bed.

Crude oil used to be priced on such things as gravity and sulfur content, for the most part. But nowadays, what with the octane race and all like that, refiners are hounding their crude buyers to scout out the crudes with the best pona ratings. That is a good share of the explanation of why the price of crude in some fields has gone up recently while it has gone down in others. It's the pona that makes the price.

If you want more technical details —we don't, but if you do—investigation probably would show that there are ways by which these miraculous cat reformer gadgets can make good gasoline out of punk-pona crude. But it costs a lot more. So, to use a brutally frank definition, pona means dough.

Maybe it's all very confusing, but we can be thankful for one thing: Since this new term is going to be forced on the industry, just be glad those laboratory chaps came through with a simple word like pona instead of trying to foist on us one of their characteristic long-hair scientific monikers like, maybe, dioxyisoproplhexyloctolene.

—Henry D. Ralph

BAKER Packers put the "permanent" in permanent-type completions

When you select a Packer for a Permanent-Type Well Completion, remember this fact: of all the tools used in permanent-type well completions, only the PACKER is required to be *permanent*. Guns, Extensions, Plugs, Gas-Lift and Circulating Valves can be removed or replaced on wire line . . . but the Packer, like the casing, is required to perform for the life of the selected producing intervals. Baker Packer Completions are *permanent completions* from the standpoint of packer performance.

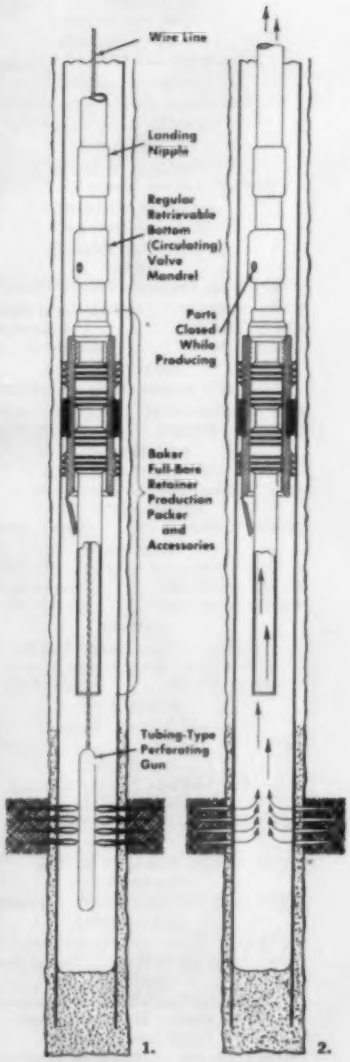
Baker Retainer Production Packer Product No. 415-D

Baker Retainer Production Packers have many important advantages . . . Meet dimensional requirements of Permanent-Type Well Completions; provide permanent, reliable pack-off which will hold against any pressure differential (from above or below) that is safe for the casing; Tubing String is free because neither set-down tubing weight nor tubing tension is required to achieve and maintain pack-off, although the tubing may be anchored to the packer if desired; Tubing String readily removed. Packer can be set on a wire line; is readily drillable, and can be used as either a Squeeze or Production Tool.

BAKER OIL TOOLS, INC.

BAKER

HOUSTON • LOS ANGELES
NEW YORK



One of the many types of Permanent-Type Completions is shown above. After perforating (1) and retrieving the cable head and collar locater, the well is put on production (2). All subsequent work-overs, such as squeeze cementing to improve gas/oil ratios, are conducted with special tools which are run through the tubing string.

Now we can put sense in imports limitation

IN the new foreign-trade law, Congress has established a definite policy that petroleum imports are to be limited to the extent necessary to maintain the domestic oil industry in a position to contribute the maximum to national security.

This is not a policy of national self-sufficiency in oil. There is little cause to believe that application of the policy will lead to complete exclusion of oil imports or even to a very severe reduction below their ratios of recent years.

This ought to reduce the subject to a size that can be discussed factually, and put an end to frenetic propaganda for and against any and all oil imports.

MANY PROBLEMS must be worked out to put the new policy into operating practice. This will involve some trial and error by the administration, and can be smoothed by constructive and well-considered suggestions from all segments of the industry.

The proper level of imports at any given moment will perhaps always be a matter of dispute. The law lists several criteria, but all of them are subject to varied interpretations. This has the virtue of making the program sufficiently flexible to meet all sorts of future conditions.

The application of these standards for controlling imports will require the exercise of judgment by the administering officials. If they are aided by accurate statistical studies and analyses, perhaps in time there will be agreement on the meaning of such phrases as "the impact of foreign competition on the welfare of individual domestic industries."

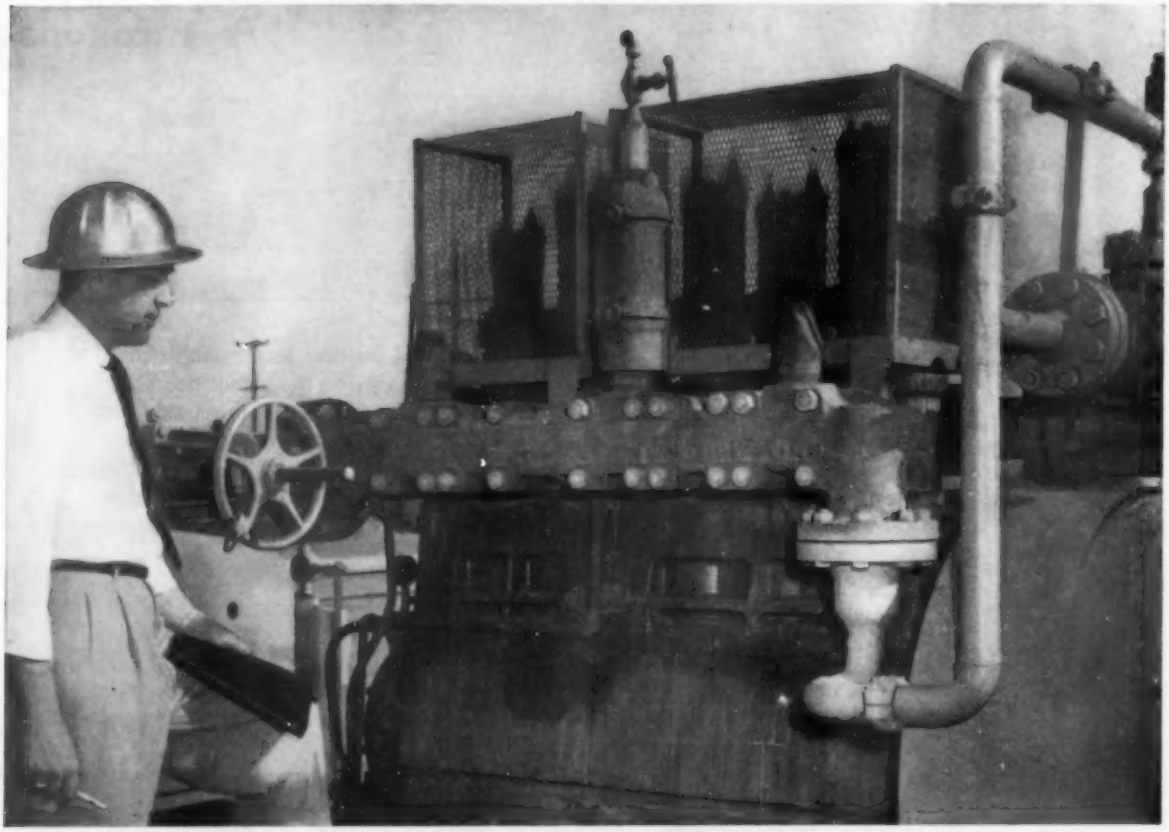
The means of limiting imports and of dividing the total among sources of origin and among individual importers is left entirely to the discretion of the administration. Here too is flexibility which could work out better than any rigid formula that Congress might have written.

OBVIOUSLY, with the policy set for at least 4 years, the administration should now stop its improvising and piece-meal approach to the problem, and buckle down to evolving a more realistic formula and enforcement program.

There now seems little point in continuing the pretense that this is a voluntary program. The law is clear enough to end any nonsense over failure to secure compliance.

There may once have been sound fears that the alternative to a voluntary program was federal regulation of the domestic industry, but the new law admits no possibility of this.

In short, the new law looks like a happy compromise of conflicting views. It can launch a practical limitation program provided the administration, the importing interests, and the domestic interests approach it with that end in view.



Nickel-aluminum bronze protects the fluid ends of pumps made by Aldrich Pump Company of Allentown, Pa. from costly salt water corrosion. Philadelphia Bronze and Brass Corporation is supplying Aldrich with nickel-aluminum bronze (5% nickel) working barrels, suction and discharge manifolds, valve spring retainers, stuffing boxes, gland rings, studs and nuts for stuffing boxes, and plunger rod bushings.

Pumps salt water... is 6 times more corrosion-resisting with nickel-aluminum bronze fluid ends

No working barrel failures and no evidence of corrosion after two to three years service

Salt water corrosion of pump parts was a serious and costly maintenance problem at a California waterflood. In some cases corrosion fatigue knocked out carbon steel working barrels within a short two to four months. And other fluid end parts had to be replaced much too soon. Then...

the Aldrich Pump Company introduced fluid ends of Ni Bral*, nickel-aluminum bronze

Highly resistant to corrosive salt water, working barrels of nickel-aluminum bronze have neither failed nor shown evidence of corrosion after two to three years service at discharge pressures up to 5200 psig.

And nickel-aluminum bronze is not only boosting the service life of the other fluid end parts, it is also providing these parts with better pressure tightness, improved wear, and greater strength.

Proves ideal for oil field service

Experience from this and many other cases shows that nickel-aluminum bronze gives efficient protection against both treated and untreated oil field brines and sea water... that it provides the properties needed for reliable performance of pump components, valve discs, and housings in corrosive oil field service.

Whether your metal problem is with pumps, or some other type of equipment, send us the details. Our Development and Research Division will be glad to work with you and help find a solution. *Registered trademark

The INTERNATIONAL NICKEL COMPANY, Inc.
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INCO NICKEL

NICKEL ALLOYS PERFORM BETTER LONGER

API Takes New Tack on Public Affairs

• A new, decentralized organization next week will take over the twin jobs of public information and legislative fire fighting. It joins OIC and APIC activities into one effort financed by perhaps $5 million or more a year.

THE OIL INDUSTRY is making the first major change in a 12-year-old public-relations program on which the industry has spent upward of $29 million in direct costs.

With many of the preliminaries already out of the way, on September 1 a formal merger will take place for the two big oil agencies which previously directed the industry's public-affairs activities.

They are the American Petroleum Industries Committee, concerned primarily with governmental relations, and the Oil Information Committee of the API, concerned with public relations.

Starting next month these two will be consolidated and their work coordinated through a new API Committee on Public Affairs.

Principals involved in the merger are convinced that when details are completed the new CPA will do a far better job than the APIC or OIC ever did separately.

Why the change . . . The moves are seen as a new approach to a cure for the oil industry's sick public relations.

The OIC program has been under fire within the industry for the last year and half. Many oil leaders openly questioned whether the $29,257,687 spent in 12 years was worth while.

They used as ammunition these facts:

. . . **Only small gains** in favorable public opinion toward the industry.

. . . **Rash of investigations** and grand jury probes of the industry.

. . . **Open attacks** against oil activities in Congress.

The OIC came into being in 1946 after a public-relations survey revealed that Americans knew too little about the oil industry. At that time 69% of the public held a favorable impression of the industry. Subsequent studies showed 31% felt oil profits were too high, 57% thought oil industry was controlled by a few companies and prices were set by suppliers, and 15% favored governmental regulation.

A 1956 opinion study revealed that 75% of the public held a generally favorable impression of the industry, a gain of 6% in 10 years. Those who felt oil profits were too high had dropped to 23% while only 12% favored regulation. But 66% felt prices were set by suppliers, and 62% still believed a few companies controlled the industry.

The gains were obvious, but critics

"To meet more effectively . . . problems that have plagued us . . .

Statement prepared for the Journal by API Chairman H. S. M. Burns.

"On September 1, the consolidation of the American Petroleum Industries Committee and the Oil Information Committee will be a reality.

"To bring this long-awaited and much-hoped-for event about, many people—members of the American Petroleum Institute and staff employes of the Institute alike—have worked long and hard. So well have they laid the groundwork that consolidation has already been successfully achieved in several states.

"It has been aptly said that until now our industry has had a government-relations program that made frequent use of public-relations methods, and a public-relations program which had, for its basic objective, a government-relations goal. Now the two programs are being joined—and let me emphasize that the marriage did not originate with the thought that two can live as cheaply as one.

"By disseminating information on which the public can base reasonable opinions, by developing a climate in which a privately managed and competitive oil industry can best serve the country, and by stimulating members of the industry to assist government in matters affecting industry and its customers, the new Committee on Public Affairs will enable us to meet more effectively many of the problems that have plagued us until now.

"The committee deserves the support of every member of the industry. I am confident it will have that support."

questioned whether they were large enough to justify the cost. The OIC budgets from 1948 through 1958 ranged from a low of $1.6 million in 1950 to a high of $3.2 million in 1954. The 1958 budget called for expenditures of $2,767,810.

These expenditures were direct costs and did not include the salaries or expenses of volunteers who participated in OIC activities or the out-of-pocket costs to oil companies for promotional posters, literature, and films.

In spite of these expenditures, the oil industry came under attack through misinformation during the oil lift to Europe in the Suez crisis, was subjected to pricing and monopoly investigations, and has been criticized repeatedly by congressmen from consumer states. Many of the attacks went virtually unanswered or the answers came too late to be effective.

While the OIC came under fire, the APIC escaped. The very nature of APIC work kept it out of the limelight. Its representatives worked quietly at the state levels with legislative and state governmental groups to protect the industry from unfair or discriminatory legislation. Cost of this work has been estimated at roughly $2.5 million annually or $27.5 million in the last 11 years during which OIC also has been in full operation.

The strategy . . . Many leaders in the industry felt the OIC came in for some unfair criticisms.

The OIC program was set up as a long-range educational and promotional type affair. Handling of spot news events was left to other agencies of the industry. Handling Washington relations certainly had not been an OIC function.

They felt the OIC and APIC had a common goal: Creating a better climate for oil—whether with the public or with governmental units. The two should work effectively under one banner. That's how the proposal to merge the two developed.

The new program already is taking shape.

First move was creation of a Washington office separate from the public-relations setup. Frank L. Dennis, newspaperman and lawyer, was named special assistant to the API president and assigned to the Washington office.

Early in June API President Frank Porter appointed members of the new Committee on Public Affairs and named John H. Bivins staff director. Bivins had the same job with APIC, and now has charge of merging his former organization with the OIC.

All but a few of the 41 state and District of Columbia organizations had been consolidated by last week. Others will follow soon in the wake of meetings recently in New York, Atlanta, and Chicago of combined APIC and OIC field staffs.

Consolidation of the two former New York headquarters staffs into a single office also has been effected. All members of both staffs were retained. Bivins and the new CPA staff setup were located on the twentieth floor of the RCA Building. The previous research, inquiries, and economics departments of APIC and OIC were combined on the fourteenth floor.

The new setup . . . The new state organizations that are being formed will be completely autonomous.

Each will select its own name, make up its own committee, determine where its offices will be located, hire its own staff, determine its program, and finance itself.

Field staff men of the APIC and OIC for the most part will staff the state organizations. Over-all leadership will be maintained by liaison between state groups and the Committee on Public Affairs through the committee's New York headquarters.

The reorganized state groups will direct the oil industry's activities with state governmental and legislative bodies as well as promote the industry through publicity and educational campaigns.

New groups being formed offer a variety of names—the Michigan Petroleum Institute, the New York State Petroleum Council, Kansas Petroleum Industries Committee, and New Mexico Petroleum Industries Committee. These all represent mergers of APIC and OIC in their states.

In some states no merger will take place. For instance, past arrangements in the West Coast, Texas, and Oklahoma will be maintained.

Neither APIC nor OIC functioned in the West. There both jobs were handled by the Western Oil and Gas Association. This will continue in California, Oregon, Washington, Nevada, and Arizona. In Texas, governmental relations will be handled by the Texas Mid-Continent Oil and Gas Association and other industry associations. The Mid-Continent Oil and Gas Association will perform similar work in Oklahoma. In both Texas and Oklahoma a separate organization will be formed along the lines of OIC to handle general public relations within the two states.

Former APIC men will play a dominant role in the new setup. In nearly all instances so far the new state organization is headed by a former APIC man with the OIC man the junior representative.

Principal state offices will remain where APIC offices have been located. There are some exceptions where states have two or more offices. Three are in this category so far: New York with offices in Albany, Buffalo, and New York City; Illinois with offices in Chicago and Springfield; and Pennsylvania with offices in Philadelphia and Harrisburg.

It's still too early to estimate the over-all cost of the new program since each state will finance its staff and program separately. This means oil companies, instead of making large contributions to the national organization, will contribute to state groups. This is expected to mean a larger number of contributors and greater interest on the part of local companies and divisions of interstate firms.

The consolidated work likely will cost very little less, but industry leaders hope to achieve a more effective program at about the same cost by:

. . . Giving unified direction and purpose to both governmental and public relations.

. . . Ending some of the confusion created in the two previous programs. Many oil men volunteering for work with both the APIC and OIC often had a confused idea of what their objectives were.

Now these volunteers will belong to one organization instead of two, attend one meeting, and have a better concept of what is trying to be achieved.

The payoff, it is hoped, will be a more favorable public opinion of oil.

OIC's 12-year Cost Exceeds $29 Million

1947*	$1,000,000
1948	1,855,000
1949	1,575,000
1950	1,619,000
1951	2,568,500
1952	2,800,000
1953	2,966,426
1954	3,223,041
1955	3,075,000
1956	3,195,000
1957	2,612,910
1958	2,767,810
Total	$29,257,687

*Budget of API Public Relations Operating Committee which preceded the OIC.

CEREMONY at Lebanon, with Texas Eastern Senior Vice President Millard K. Neptune at the microphone.

Old Line Reverts, Writes New History

THE LITTLE BIG INCH pipeline last week was ceremoniously and officially converted back to products service.

More important than the ceremony itself was its significance—a shift in the supply and distribution pattern between the Gulf Coast and the Ohio Valley.

Pipeliners already are calling the conversion the most important event in products pipelining since the Little Big Inch was built 15 years ago from Beaumont to Linden, N. J.

The government-built, 20-in. line made history in 1943-45 by freeing tankers from the submarine-infested Gulf Coast-East Coast run. By making them available for war duty, it made possible the Normandy invasion a year ahead of schedule.

It also proved that you could pump products through a line as large as 20-in. And it pointed up the economy of large-diameter pipe for products.

For 10 years it pumped gas for Texas Eastern Transmission Corp., which bought the 20-in. line and its Big Inch companion in 1947. Now back in products service as a privately owned common carrier, it may have as much impact on the industry as it did when it was built.

The reconversion promises to:

... **Solidify the Gulf Coast** as the nation's largest refining center.

... **Open Midwest markets** to Gulf Coast, Arkansas, and Oklahoma refiners to a greater extent by offering common-carrier transportation.

... **Make service** more reliable to certain markets than could be provided by river barges.

... **Stimulate growth** of LPG markets by cutting transportation costs into the Mississippi and Ohio valleys and to the East Coast.

Expansion opportunities . . . Prime examples of what the Little Big Inch can mean to some Gulf Coast refiners are Phillips Petroleum Co. and Magnolia Petroleum Co.

These companies were among the first to tender cargoes when the pipeline started operating. Phillips is now able to enter the southwestern Ohio market in a big way. Magnolia's parent, Socony Mobil Oil Co., Inc., plans to expand in that area.

Phillips' largest refinery, located at Sweeny, below Houston, is connected by its own pipeline to the Little Big Inch at Pasadena. Phillips has already made deliveries to several terminals on the line and plans to ship to the terminal at Lebanon, Ohio, the easternmost point at this time.

Socony received the first shipment through the $2,000,000 Lebanon terminal August 16. It was a premium-gasoline batch of 50,000 bbl. from the Magnolia refinery at Beaumont.

Socony formerly served this market by barge from its East St. Louis refinery. By shipping through the Little Big Inch from Beaumont, Socony expects to be able to expand operations in southwestern Ohio.

Capacity of the line is 185,000 bbl. daily. It is nowhere close to full-scale operation yet. But throughput is building up as marketers revise their plans in order to take advantage of the first common-carrier line between the Gulf Coast and the Midwest.

LPG shipments . . . Some LPG has already been shipped on the Little Big Inch, and Texas Eastern is working hard to build this business into a major-volume item.

Propane shipments of 180,000 and 165,000 bbl. have been made from the Gulf Coast to Lebanon. Nearby is the Todhunter underground shale storage which will hold 12,000,000 gal. when completed next year (OGJ, July 28, p. 115). Tariff was 56 cents a barrel. Tank-car shipment would have cost several times as much.

Pending completion of Todhunter, the Lebanon-Moundsville, W. Va., section of the line is serving as storage. It holds some 300,000 bbl.

Next year, however, Moundsville can become the easternmost terminal. It's also probable that either a Little Inch extension or connection with another line will provide LPG pipeline service from the Gulf to New Jersey.

Growth is coming . . . At least two East Coast companies are in the market for substantial volumes of LPG.

Socony and Sinclair Refining Co. could use 1,000 bbl. a day each at their Paulsboro, N. J., and Marcus Hook refineries. They probably would ship on the Little Inch now if it went through to the East Coast.

Texas Eastern is studying means of extending the line. Other companies also are giving thought to providing a final link.

The large concentration of LPG on the Gulf Coast, the demand on the East Coast, and the opportunity now available to connect the two by cheap transportation point to early action.

Refiners Moving in on Aromatics

• Oil already has displaced coal as the principal supplier of aromatics. Now refiners have built enough capacity to outstrip demand for years. Prices have slipped, but gasoline blending will absorb surplus until demand catches up.

REFINERS have jumped into the aromatics business in a big way.

So big, in fact, that present capacity for benzene, toluene, and xylenes from domestic refineries now exceeds total U. S. output last year.

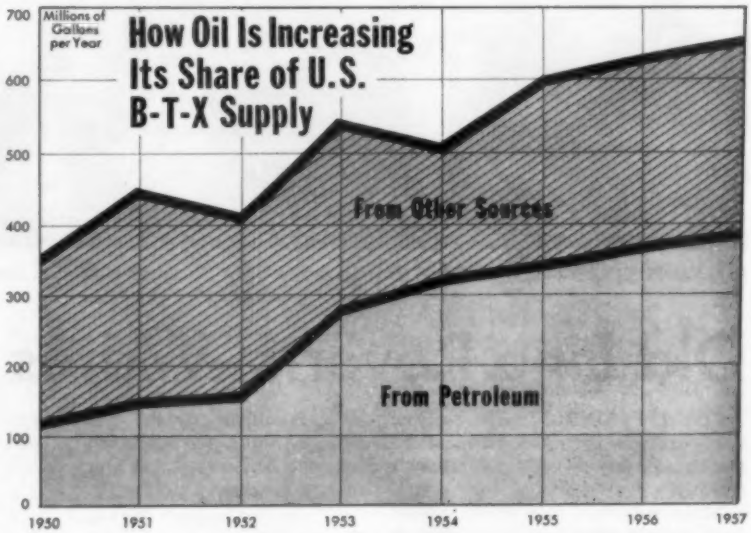
This is significant, since petroleum shared less than 60% of the 1957 production.

The question now is: What will happen to BTX prices? They're softening. Two major price cuts took effect just recently, shaving 5 cents per gallon off benzene and xylene.

But a domestic capacity which now exceeds consumption by some 65%, excluding imports, doesn't necessarily mean that the market will be shot.

Petroleum aromatics have another home: High-octane avgas and motor fuel. Refiners maintain flexibility in diverting their aromatics from chemical to fuel uses. So, the interim period when demand presumably will catch up with supply, may not be as hectic as the figures indicate.

A Journal survey of BTX capacity in the refining industry shows a total capacity for 51,000 bbl. per stream day. That's over 700 million gallons per year, roughly 50 million more than came from coke ovens and refineries combined in 1957. The trend is still moving. Next year 100 million more gallons will be added.



Why the jump? . . . This sudden mushrooming of refinery capacity for pure aromatics stems originally from the boom in cat reforming.

Refiners have been making millions of barrels of aromatics for gasoline blending for the past several years.

What sparks the current upsurge in separation capacity is the relatively good prices commanded by aromatics for chemical uses. Even after the recent price cut, 31 cents looks good to refiners who are getting 11-13 cents for their gasoline.

In fact, during the past year or so, when the gasoline market has left much to be desired, more than one plant has operated in the black only because of its BTX sales.

The oversupply is magnified by shrinking consumption. Take benzene, a prime component of synthetic rubber. This market normally takes 40% of all benzene produced. But this year the sales of new tires on new cars is off sharply.

The scoreboard . . . Present refinery capacities reported by 21 companies in the Journal survey, are listed in the table on the next page. Catalytic reforming capacity is shown only as a guide. Its relationship to extracted BTX production is dependent on individual plant conditions.

The table shows only refiners engaged in basic production of aromatics. It omits some plants which derive these chemicals from petroleum sources but which are not primarily in the refining business.

Some plants get a benzene-toluene byproduct when cracking ethane-propane mixes for ethylene production. In a few instances, reporting refiners have omitted some of their capacity figures. In others, such as Aurora and Tidewater, capacity is reported as "aromatics mix," without a breakdown as to type.

As a result, the total potential for producing pure aromatics is greater than the 51,229-bbl. total for stream-day capacity.

Outlook . . . In addition to existing plants, Gulf and Sinclair will complete extraction units in early 1959. These will add 100 million gallons per year to the aromatics capacity of the nation.

Thus the new year will be kicked off with 810 million gallons of aromatics capacity in the refining industry alone.

Where's it all going?

The answer: All of it won't find a home next year. But, looking at the long pull, refiners have put themselves in position to take care of increased demands resulting from both growth factors and new applications.

An upswing in business will help to increase demand in the months ahead. However, any general business rise and its effect on petroleum-derived aromatics has to be tempered by the realization that output of coal-derived aromatics also will increase.

Actually, the slowing down of steel production and the companion decline in production of coke-oven aromatic sources helped to ease the impact of the recession on petroleum-derived aromatics. With steel activity picking up, the reverse will be true. The upswing in coal-derived aromatics will tend to hold back the rate at which demand for petroleum-derived aromatics increases.

The betting is on demand to increase in the years ahead far beyond what it was under "pre-recession" conditions.

For example, a Humble Oil & Refining Co. study predicts that growth in demand for benzene-derived chemicals will create a total demand of 500 million gallons annually by 1965. This compares with a production of 331.5 million gallons in 1957.

The same study foresees a toluene consumption of 35 million gallons per

Aromatics Capacity in U. S. Refineries

(Barrels Per Stream Day)

Company—Plant	Reforming Unit	Capacity	Extraction Unit	Capacity	Benzene	Toluene	Xylene	Mixed Xyl.	Remarks
American Oil									
Texas City	Ultraformer	21,000	Extractive	7,000	1,000	....	....	....	.....
	Ultraformer	21,000	Distillation						
Ashland Oil (Frontier Oil Ref. Div.)									
Buffalo, N. Y.	Ashland	7,000	Udex	1,300	300	*3-500	....	*3-500	Heavy Aromatic *1-300
Atlas Processing									
Shreveport, La.	Platformer	3,600	Phenol	(†)	612	....	....	....	.....
	Platformer	3,600							
Aurora Gasoline									
Detroit	Platformer	5,000	Rexformer-Udex	5,500	....	....	....	....	3,850 bbl. mixed aromatics
Continental Oil									
Ponca City, Okla.	S.B.K.	11,000	Phenol	1,550	350	....	....	....	Tol-Xy Mix 1,200 bbl.
	Platformer	5,100							
Lake Charles, La.	Platformer	6,200	SO_2	1,900	300	....	....	....	Tol-Xy Mix 1,600 bbl.
Cosden Petroleum									
Big Spring, Tex.	Platformer	4,500	Udex	3,200	180	550	....	800	C_9 Aromatic 150 bbl.
	Rexformer	4,000		5,000					
Delhi-Taylor									
Corpus Christi, Tex.	Platformer	5,000							
	Platformer	10,000	Udex	5,000	1,000	800	....	700	.....
Eastern States									
Houston	Platformer	12,000	Udex	9,000	350	985	....	1,260	.....
Esso Standard									
Baton Rouge, La.	Fld. Hydro-former	25,000	Extractive Distillation	600	600	....	....	....	.....
Humble									
Baytown, Tex.	Ultraformer	23,000	SO_2	5,000	2,500	5,000	5,500	....	Solvent xylene
	Ultraformer	23,000	Udex	10,000	....	....	600	....	Paraxylene
Leonard Refineries									
Mount Pleasant, Mich.	Platformer	1,800	Udex	1,200	250	250	....	30	.....
Pure Oil									
Toledo, Ohio	Hydroformer	5,500	Phenol	4,550	....	620	....	1,260	.....
Richfield									
Wilmington, Calif.	Sinclair-Baker	5,480	Udex	3,500	1,074	1,313	....	....	Only small quan.
	Sinclair-Baker	17,000	None	....	....	....	....	335	Toluene is nitration grade
Shell									
Houston	Platformer	14,200	Shell	11,500	1,000	2,200	....	....	.....
Wilmington, Calif.	Platformer	3,500	Shell	2,600	....	‡900	‡800	....	.....
Wood River, Ill.	Platformer	4,000	Shell	3,400	....	‡1,200	‡1,400	....	.....
Sinclair									
Marcus Hook, Pa.	Sinclair-Baker	16,000	Udex	3,000	....	400	105	1,000	Paraxylene prod. is 105 bbl.
California Standard									
El Segundo, Calif.	Platformer	12,500	.....	....	1,500	....	....	....	Also produces Tol. and Xyl.
Indiana Standard									
Whiting, Ind.	Ultraformer	21,000	Udex	9,100	1,100	1,870	....	925	.....
	Ultraformer	21,000							
	Ultraformer	14,000							
	Hydroformer	14,000							
Sun									
Marcus Hook, Pa.	.....	14,000	.....	....	1,360	2,150	....	1,290	.....
Suntide									
Corpus Christi, Tex.	Platformer	11,000	Udex	4,700	310	900	800	....	Also 190 bbl. xylene btms.
Tidewater									
Avon, Calif.	Platformer	10,000	SO_2	8,000	....	....	....	....	1,200 bbl. mixed aromatics
	Houdriformer	22,500							
Delaware City	Houdriformer	45,000	Udex	40,000	....	....	....	....	20,000 bbl. mixed aromatics
Vickers									
Potwin, Kans.	Ultraformer	3,000	Udex	2,500	100	400	....	400	.....

*Fluctuates to meet market conditions. †Atlas processes entire plant stream of extraction plant gasoline through 19,000 B/CD fractionation equipment. ‡Alternately on blocked-out operation.

CONSTRUCTION

Eastern States, Houston
Aromatic alkylation unit (Alkar UOP), 600 bbl. per day product capacity. Estimated completion 12-31-58.

Gulf, Port Arthur, Tex.
Catalytic reformer and aromatics recovery unit with over 30 million gallons capacity for benzene annually, plus toluene production. Estimated completion, early 1959.

Sinclair, Houston
Udex extraction unit to recover 5,000 bbl. per day of aromatics plus a paraxylene recovery unit with 60 million pounds per year capacity. Estimated completion, early 1959.

Suntide, Corpus Christi, Tex.
Ortho-xylene fractionation unit with a 1,500-bbl. per day capacity for removing o-xylene from paraxylene and metaxylene mix. Estimated completion, third quarter 1958.

year, compared with production of 173.6 million last year.

The real comers, however, are the xylenes. Last year's production was 136 million gallons. By 1965, consumption is expected to hit 300 million.

For aromatics generally, the estimated demand by 1965 should be quite close to today's existing capacity in the U. S.

Coal-tar aromatics are tied in closely to steel production, and, if it is assumed that only a moderate growth can be expected here, the petroleum refining industry will continue to account for a greater and greater proportion of aromatics output.

In the interim . . . On the surface this excess capacity could be uncomfortable for the next few years.

This is not an uncommon situation in the chemical field, however, where an anticipated demand will spur many producers to build plants which come onstream at about the same time and cause a glut on the market.

Fortunately, the refiner has a great deal of flexibility. The output from a reformer can be diverted entirely to the gasoline pool, if the operator desires. In fact, some plants use extraction units simply to pull out a heart-cut aromatic mix for avgas and use the remaining aromatics for motor fuel, ignoring BTX entirely.

These conditions, naturally, vary according to individual plant conditions. Significantly, the flexibility means that a home can be found for the aromatics without their being dumped on the market and undermining prices.

This flexibility means that the transitional stage, wherein demand catches up with supply, will be more orderly than it might be otherwise. Prices will be affected to a degree, but disastrous price-cutting probably will be avoided.

Pressure will build up against imported aromatics. The business of "carrying coals to Newcastle" no doubt will receive an economic jolt, especially when its realized that crude benzene is actually imported from Iron Curtain countries into the Texas Gulf Coast area, which abounds in aromatic productive capacity.

One of the real benefits of the overcapacity may be an increased emphasis on product development.

It wasn't too long ago that aromatics were in short supply in this country. At that time high prices and scarcity made product development more of a long-range project. Now, however, lower prices and excess capacity makes them a natural for the researcher.

Texas-Florida Gas Line

. . . will be started after years of planning. Project finally is financed, and main-line contracts soon will be awarded.

CONSTRUCTION of the long-debated pipeline to move Texas and Louisiana natural gas to Florida is scheduled to begin immediately.

With the public offering of more than $54 million of stocks and debentures, Houston Corp. completed the long uphill struggle for approval and financing of the 1,516-mile transmission line.

Construction of certain of the lateral lines to supply the system is expected to begin within a few days—perhaps before the end of the week—in South Texas. Plans call for letting first contracts for construction of the main line within 2 to 4 weeks.

Barring unexpected construction delays, the line is scheduled to go into operation about next June 1.

What it does . . . Completion of the line will bring to realization a dream which was first scoffed at 4½ years ago (OGJ, Mar. 8, 1954, p. 60).

The elaborate system will move gas from deep in South Texas through South Louisiana, one of the most prolific gas-producing regions in the country, and deliver it to the last major area in the United States now without natural gas.

The project already has another claim to fame as a triumph for private enterprise.

It is the first major interstate transmission system to purchase gas reserves, get Federal Power Commission approval, and line up initial financing since the controversial "Phillips decision" of 1953 which placed gas producers under federal price controls.

Many-sided project . . . Perhaps because of the many barricades repeatedly erected in front of it, the Texas-to-Florida project is an unusually complicated one.

The corporate setup is an example of such complexity. The line will be built and operated under two wholly owned gas-transmission subsidiaries of Houston Corp.

Coastal Transmission Corp., with headquarters in Houston, will build more than 400 miles of supply lines in South Texas and about 560 miles of main line from Hidalgo County, Texas, to a point about 10 miles east of the Mississippi River near Baton Rouge, La.

From there, the system will be extended into Florida by Houston Texas Gas & Oil Corp. The eastern leg of the system will include more than 900 miles of main line extending to a point in Dade County, south of Miami. The company also will construct some 715 miles of laterals to serve more than 60 distributors and industrial customers in Florida.

Another wrinkle . . . Two other companies also enter the corporate picture, not as owners of the line but as users of it.

These are Florida Power & Light Co. and Florida Power Corp. They have purchased gas in the field and

will pay for transportation of their own gas by Coastal and Houston Texas Gas & Oil.

The combined 24-in. main line will move about 282,000,000 cu. ft. of gas daily during the early stages of operation. Of this volume, the two power companies will take about 15,000,000 cu. ft. per day.

This so-called "transportation" gas played an important part in the planning and financing of a line which will serve a relatively warm climate. Without it, the line probably could not have been built. Because it is subject to less-stringent governmental controls, transportation gas is becoming an important factor in future expansion plans of other pipeline companies which have been in business for years.

Market limited—but . . . Although the Florida market has a limited space-heating potential, existing gas demand for industrial uses greatly exceeds initial capacity of the line.

Southern California, with a similar climate, is one of the most rapidly growing gas markets in the country. Plans for the new line to Florida already call for increasing its capacity to about 400,000,000 cu. ft. daily during the first year of operation.

The public offering, made through a group of large underwriting firms, put Houston Corp. securities on the market in "packages" at $150 per unit. Each unit included a $100 debenture and five shares of common stock.

Brokers in some areas reported the demand was three or four times as great as the supply. Within 24 hours of the offering, units were said to be trading in New York at $160.

Microwave System Started

MAGNOLIA Pipe Line Co. has started work on a 267-mile microwave system to handle voice communications between its headquarters in Dallas and its huge refining center at Beaumont, Tex.

The system, which will cost roughly $400,000, also will be used for remote control of pump stations at Grapeland, Groveton, and Bragg, Tex., on the company's 20-in. crude line between Corsicana and Beaumont.

Contract to install the system is held by Motorola Communications & Electronics, Inc., Chicago.

Work on the sites for 11 towns has started, and Magnolia expects that all of the 160-290 ft. towers will be up and equipment installation under way by mid-September. Final tests of the system are expected to begin early next year.

Computer Measures Variables for Esso

ENGINEER-OPERATED slip sticks are being put to better use as a new computer (photo) takes over the job of keeping tabs on a fluid cat cracker at Esso Standard Oil Co.'s Baton Rouge refinery.

The operating guide computer system, engineered and constructed by Leeds & Northrup Co., measures 160 process variables. Included are 27 computed guides such as catalyst circulation rate, carbon burning rate, material balance.

It prints out off-normal conditions and provides on-demand, hourly and daily log sheet summaries of the operation. It's the first of its kind in a process industry.

Texas Hikes Allowable Again

THE TEXAS oil allowable September 1 will go over the 3,000,000-bbl.-daily mark for the first time since last February when the Railroad Commission started chopping production drastically to combat high stocks and purchaser proration.

The agency last week adopted a 12-day producing schedule for September. This will mean an initial allowable next month of 3,173,736 bbl. daily. The increase, which amounts to 196,525 bbl. daily over August's initial 11-day allowable and 237,710 bbl. daily above that in effect August 9, will be the fourth consecutive monthly production gain in the state's slow but steady drive toward recovery.

The September allowable is the highest since late in February when it held barely over 3,000,000 bbl. daily. March 1, the allowable fell sharply to 2,544,362 bbl. daily. It continued to slide downward to a low of 2,394,537 bbl. daily as of May 1.

Still careful . . . Despite the four straight allowable hikes, however, the commission is still treading cautiously.

Testimony of major crude buyers at the allowable hearing indicated nearly all could absorb more oil than the 12-day pattern will produce.

Humble Oil & Refining Co., one of the state's biggest oil buyers, told the commission it would need at least 14 days' production to meet its crude needs. The Texas Co. and Atlantic Refining Co. recommended 13. Several more of the major buyers who recommended 12 days indicated they still would have to resort to spot buying on that pattern to meet requirements.

Magnolia Petroleum Co., for instance, testified that its crude stocks currently are 900,000 bbl. below desirable levels.

Both Humble and Texaco have said at recent allowable hearings that they have lost tanker sales of oil due to their inability to spot buy enough crude at existing allowable levels.

Independent spokesmen at last week's session lauded the commission's contribution to the firming market and continued to urge a policy of restraint in fixing allowables.

Smackover's Problem

How to stop pollution without going broke?

Smackover's Statistics

1,500 stripper wells
300,000 bbl. salt water daily
15,000 bbl. of oil daily

Stripper Operators Fight for Time

SCORES of small Smackover field oil producers—and some big ones, too—who have enjoyed the luxury of dumping salt water into the lower Ouachita River basin for 35 years are faced today with an expensive ultimatum: Stop pollution.

The aging southern Arkansas producing area, which once had 3,100 wells and nearly 500,000 bbl. of daily crude output, still has a great reserve wealth despite its stripper status.

The life-and-death question of the moment is this: How can the producers finance a high-cost, salt-water reinjection program and still keep their wells going at a profit?

If the governments of Arkansas and neighboring Louisiana had been as zealous to halt pollution a generation ago as they are today, well owners would have been able to pay the tab in the days of flush production. Today much of the field consists of marginal wells run by small operators unable to shell out large sums of money for pollution abatement.

In fact, this multiple ownership has had another stifling effect: There has been no unitization that would make possible a giant water-flooding project to recover millions of barrels of crude which remain untouched.

If and when the myriad well owners unite on an antipollution program, they may at last see the virtue of another cooperative venture—secondary recovery.

The problem . . . The Arkansas Water Pollution Control Commission brought the pollution issue to the fore last April by issuing a "Summary Report on the Smackover Creek Drainage Basin."

The pollution facts were no surprise. Since the early boom days of the field, when unrestricted flow of oil and gas from big gushers produced salt water to contaminate the low-gravity crude, treating systems have emptied their brine into Smackover Creek, a Ouachita tributary.

The 1,500 stripper wells in the field today are surfacing more than 300,000 bbl. of salt water per day to produce about 15,000 bbl. of oil. By weight, this is 5,062 tons of salt daily.

In past years, the principal complaints against pollution came only from sportsmen in the piney woods of southern Arkansas. They objected because the salt made their fishing holes intolerable to fish.

But more recently officials of Monroe, La., a fast-growing city with heavy water demands, have applied pressure to clean up the Ouachita as a source of water. Monroe, with a population of 38,375 in 1950, has an estimated 50,400 persons today and expects to have 55,000 by 1960. It has used some Ouachita River water but finds it undesirable particularly during drouth periods.

Brine from Smackover is not the only source of pollution to the river. Chemical companies, refineries, and others are dumping waste into the basin. However, the oil operation is the chief culprit, and the chief burden of clearing up the river falls on the producers.

Official action . . . The pollution-control commission was created by law in 1949 to control stream pollution in Arkansas and is currently embarked on a program to clean up the waters in the Ouachita basin.

It recently held public hearings at El Dorado in which it took testimony on the issue.

The commission, composed of seven members representing four state agencies and three economic segments of the state, is expected to rule this fall on what the producers must do to handle their share of the pollution.

Many of the producers have joined forces through the Arkansas Oil Association to present their views to the commission and decide what course of action to follow.

The association has handed the commission a proposed plan to halt the flow of salt water into the Ouachita, and the commission is expected to issue a ruling this fall.

The plan . . . The association wants 5 years to complete the job of reinjecting salt water or otherwise ending pollution.

In general, its proposal provides for

a gradual abatement of oil pollution in Arkansas at the rate of 20% per year —the quickest, according to the association, the job can be done within the financial means of the affected members.

Specifically the association's 5-year plan provides that:

...The commission require each operator in the state (not just those at Smackover) to reduce the volume of salt water being discharged into streams by a minimum of 20% per year.

...Operators can join together to reduce jointly their combined water production by 20% per year.

...Each operator or group would submit each year to the commission an affidavit plan through the association. The affidavit plan would name the wells, the volumes of salt water produced, and exactly how the reduction would occur.

...Water reduction would be accomplished by any of four methods—well workover jobs, abandoning wells, disposal of water in pits, and underground disposal.

Plea for time . . . To require that all pollution be ended immediately would mean financial ruin to many operators, the association contends. Many wells would have to be abandoned as uneconomic.

James H. Nobles, Jr., a producer and chairman of the association's legislative committee, explained it this way at the commission hearings:

"If any drastic changes are made in the method of production from the Smackover field, a condition which has existed now for over 30 years, the vast majority of production in the field will have to be abandoned."

Nobles estimates that 60% of the 4,761,000 bbl. produced last year in Smackover came from wells owned by independents who live in the El Dorado vicinity.

Nobles says his own company produced 491 bbl. daily last year and that if an immediate "cease and desist" order were made to halt salt-water pollution "it would leave us 65 bbl. of oil production which we could operate economically and 122 bbl. which is of doubtful character."

While for all operators the financing of a water-injection program will be costly and result in reduced profits, some of the companies will be ready to go when required to do so.

For example, Phillips Petroleum Co., which operates about one-fifth of the wells in Smackover, has a program planned to initially reduce its produced-water volumes by workover and subsequently to reinject produced water by areas in line with the 5-year plan as proposed by the association.

Phillips has a background of experience with salt-water disposal in areas like Osage County, Oklahoma, and the Oklahoma City field. It has historically participated in plans for injection systems with other operators when the time came for action.

The beginning . . . The troubles of Smackover today are vastly different from what they were 35 years ago when two wild "booms" of the 1920's splashed the field on the news pages.

In 1923 and again in 1925 the field was the talk of the oil world for the size of its gushers, its blowouts, its fires, and its lakes of oil stored in open earthen pits by the millions of barrels.

The field eventually expanded to 30,000 acres, had 3,100 wells and produced more than 456 million barrels of oil to the end of last year.

The discovery well actually came in 1922. The Oil Operator's Trust No. 1 J. T. Murphy blew out April 14, 1922, and formed a crater 450 ft. in diameter and 50 ft. deep. The well, a gasser, caught fire and burned.

The first oiler was the V.K.F. Oil Co.'s Richardson No. 1, completed in the Nacotoch sand July 1, 1922, at about 2,000 ft.

Nearly 1,000 wells were drilled in the first year and 25 million barrels of oil produced. The largest Nacotoch well gaged 25,000 bbl. daily after it had gushed uncontrolled for a week.

A second sand, the Meakin (Primm, Second Sand Stray), yielded a lighter-gravity oil but not in large quantities. A third zone, the Blossom series, came in for small wells at 2,600 ft.

Boom No. 2 . . . It was the prolific Graves sand that triggered the second boom in 1925.

A terrific water drive in the Graves was evident in the discovery well, which had an initial production of 6,000 bbl. of fluid per day—30% oil and 70% hot salt water.

Within a short period 350 drilling rigs were in action, and within 10 months 850 Graves wells reached a peak output of 393,000 bbl. per day.

By the close of 1925 the entire Smackover field had 3,100 wells, and the largest production for any one day was close to 500,000 bbl.

The big flood of oil could not be marketed as fast as it came out of the ground. This led to the construction of the enormous earthen pits.

High treating costs, combined with large volumetric losses, resulted in lower profits.

The decline . . . Soon production declined rapidly, and the 1929 depression made it less attractive to produce Smackover crude.

The result: Many operators sold their leases. During the 1930's many familiar names disappeared from the field maps.

In this depression-ridden transition period some properties changed hands several times. Operators rewarded faithful employes by transferring ownership on an easy payout basis from future oil runs. In this manner individuals could afford to operate marginal wells that could not bear overhead charges.

Today these small operators form an important segment of the Smackover field ownership. They exchange labor with each other to avoid payroll charges. They pump their own wells and keep equipment running even when it has become so obsolete that the only source of parts is another old machine of the same make.

They purchase used material when available and effect other economies of operation that help to keep the lease going. One owner of 17 wells was interviewed while he unloaded chunks of shale from his pickup truck to fill a chug hole in the lease road.

Regulation . . . It was not until 1939 that Arkansas got around to creating the Arkansas Oil and Gas Commission.

But, even then, the commission's authority did not extend to the old Smackover field which, even today, remains uncontrolled as to production. However, the commission does exercise jurisdiction over pay zones discovered since 1939, including those at adjacent Snow Hill.

In the early 1940's the commission sponsored an engineering report on secondary recovery in Arkansas. The report, issued in 1946 after 4 years of survey work, showed the Nacotoch sand still had 328 million barrels of oil in place to challenge the ingenuity of the oil operators at Smackover.

Since then, however, there has been little cooperative effort leading to secondary-recovery projects, except for some gas injection.

But the present salt-water pollution blight may lead to more cooperative thinking on other matters. Brought together to whip a common problem, the operators may turn to a unitization program for water flooding and go after some of the millions of barrels of oil the engineers say are still in place.

That's a far cry from the raucous days of destructive competition a generation ago, but it may fall on receptive ears once the salt-water problem is solved.

Polypropylene Moves Up

...as important new plastic with Humble's decision to build plant at Baytown. Enjay will market the output.

HUMBLE Oil & Refining Co. will provide the first big breakthrough for polypropylene, a plastics newcomer with great potential.

Humble announced last week it will construct a polypropylene plant at Baytown, Tex., with a capacity of 40 million pounds per year.

The decision of Humble to build the plant at Baytown is vastly important for polypropylene, although the plant will not be the first. It will be, however, the biggest.

The first was an Italian installation built by Montecatini. Last December Hercules Powder Co. brought the world's second polypropylene plant on stream at Parlin, N. J., where it turns out 20 million pounds per year. The Hercules product is made from high-purity propylene supplied by Sinclair Refining Co. at Marcus Hook, Pa.

Marketing . . . Enjay, Inc., will market the output of the plant. Both Humble and Enjay are Standard Oil Co. (N.J.) subsidiaries.

Enjay President O. V. Tracy said commercial quantities of the polymer will be available in early 1960. He announced also that an agreement has been reached by Enjay and Spencer Chemical Co. whereby Spencer will be supplied with polypropylene for resale throughout the U. S.

Market development quantities of the product will be available soon from a ton-a-day pilot plant.

Its importance . . . Polypropylene has been described as one of the most versatile of the new plastics. It is a linear polymer and will be produced from refinery propylene gases.

Hailed as a large-volume petrochemical, the plastic is considered a comer. It has properties not possessed by polyethylene and is a different plastic entirely.

The end-use potential of polypropylene has not been thoroughly tested in the marketplace. But it looks like a strong contender.

Its biggest asset is a high melting point—over 300° F. Also it is stronger, tougher, and lighter in weight than any of the polyethylene types.

Further, it is possible to control the structure and molecular weight of the long propylene chains formed by catalysis. This makes for tailor-made physical and chemical properties.

Polypropylene will compete in the general field of plastics for use in films, packaging, pipes, valves, steering wheels, fittings, cable insulation, and a host of household products.

The new polymer has an abundant raw material supply. Practically every refiner in the country makes propylene.

But the classic end use—in polymer gasoline—is beginning to wane. Some refiners are shifting their propylene to alkylation for better road octane blend stocks.

The question today is: Will propylene swing mostly to alkylate or to chemicals? Only 10% now goes into petrochemical units. Some market analysts believe this olefin's future lies primarily in petrochemicals, and polypropylene may become a dominant factor.

Import Plan Upheld

in Eastern States test. Full-scale trial is yet possible.

THE VOLUNTARY imports program has successfully weathered its first court test—a charge that the quota for Eastern States Petroleum & Chemical Corp. was not set on its merits but by arbitrary action.

This was marked by the second refusal of the District of Columbia federal court to grant the company an injunction to review a jet-fuel contract canceled by the Military Petroleum Supply Agency on the ground that Eastern States was not in compliance with the import program.

The company charged that Capt. M. V. Carson, Jr., imports administrator, refused to consider its claim of a clerical error in reporting planned imports and arbitrarily denied the company a proper quota.

The decision came from the same court—but a different judge—which last month denied the company's petition for an injunction against the cancelation of the contract (OGJ, July 14, p. 74).

The suit was returned to the court by the circuit court of appeals, to which Eastern States appealed the original decision. But the higher court, saying nothing about the merits of the company's challenge of the legality of the whole import program, merely told the district court to take a second look at the charge of "arbitrary action."

With its moves for an injuction blocked unless it takes another appeal, Eastern States cannot get back its canceled government contract. But it eventually can obtain trial of its over-all suit alleging the whole voluntary import control program to be illegal.

Seaton Pushes Helium Plants

THE INTERIOR Department is paving the way for action by Congress next year on plans for a quarter-billion-dollar expansion of the helium conservation program.

Text of a bill which would allow the department to put up 12 extraction plants along helium-bearing gas pipelines was sent to the capitol last week by Sec. Fred A. Seaton.

The bill proposes that industry be invited to put up the plants under long-term contracts for purchase of the helium by the Government. But it provides that if private enterprise is unwilling, the plants should be built by the Government.

The program is aimed at saving some 3 billion cubic feet a year of helium which is now being wasted. The gas would be stored in the Government's Cliffside gas field near Amarillo, Tex., until needed.

PROCESSING

Construction is under way on British Petroleum Co. of Canada, Ltd.'s, 25,000-bbl. refinery at Ville D'Anjou, Que. The plant, being constructed by Lummus Co., will include a 6,000-bbl. catalytic reformer and a 9,000-bbl. cat cracker, plus a poly unit. This first BP refinery in Canada is scheduled to come on stream in mid-1960.

BP Canada also expects to have over 400 service stations in operation in eastern Canada by the end of this year. Since BP announced its entry in the Canadian market 18 months ago, it has built or purchased 300 retail outlets in Quebec and Ontario.

American Gilsonite Co. has started to market a new road-surfacing product, Gilsapave, through George M. Jones Co. of Salt Lake City. Gilsonite opened a $16-million refinery near Grand Junction a year ago to process Gilsonite ore into gasoline and metallurgical coke.

The company is now producing the Gilsapave product, a new cold bituminous concrete which can be laid

Canada's Depth Mark May Fall

THE RACE for the world's deep-drilling honors moved at a snail's pace last week, but a new depth record for Canada may be set soon.

The Northern Foothills Agreement Group announced it will send its Simonette River No. 8-28-60-3 to 16,500 ft., which is more than 1,300 ft. deeper than the present Canadian record.

The Simonette River well, 70 miles south of Grande Prairie, Alta., drilled below 14,153 ft. last week at the rate of 50 to 75 ft. per day. With casing set to about 13,500 ft., the well should topple the Canadian mark this week if no trouble develops.

Arrow Drilling Co. is doing the drilling for the Group, composed of Texaco Exploration Co., Shell Oil Co. of Canada, British American Oil Co., and Mobil Oil of Canada. Arrow is using a Continental Emsco J 1000 rig.

The Canadian depth record is held by the B. A. Triad et al Lambert Creek No. 6-4-51-21, abandoned at 15,195 ft.

The deeper wells . . . In the U. S., two Phillips Petroleum Co. wells in Pecos County, Texas, made no new hole last week.

The 1-EE University, the world's deepest at 24,357 ft., awaited new drill pipe before resuming drilling.

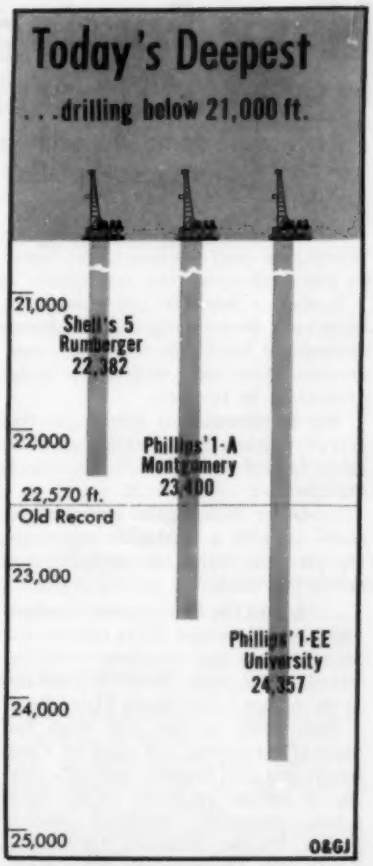
The 1-A Montgomery, which has reached total depth of 23,400 ft., succeeded in setting packer and was testing. The hole is the second deepest ever drilled.

Phillips got a "slight show of gas" in the 400 ft. of open hole below the casing, set to 23,000 ft., and was preparing to plug back and perforate in the upper part of the Ellenburger at 22,650-22,880 ft. The lower testing also was in the Ellenburger.

In still a third deep well in Pecos County, Phillips got only small gas shows. The 1-A Harral tested gas at the rate of 4,000 cu. ft. per day at 18,950-19,000 ft. in the Wolfcamp. Total depth is 19,020 ft.

Another 1-A Harral test in the Wolfcamp, at 18,790-18,900 ft., showed gas at the rate of 20,000 cu. ft. per day. Operators now are plugging back to perforate the Wolfcamp at 18,370-18,423 ft.

In Oklahoma's Elk City field, Shell Oil Co.'s 5 Rumberger drilled below 22,382 ft. in the Springer and this week should pass the old world mark of 22,570 ft, set in 1956 in South Louisiana. The 5 Rumberger is projected to 24,000 ft., which, if attained, would make it No. 2 behind the 1-EE University.



BRIEFS . . .

cold in temperatures below 35° F. The company says also that Gilsapave remains workable after being stockpiled in the open, and the product will be competitive in price with other asphalt mixes.

Commercial Solvents Corp. will begin producing caprolactam in commercial quantities by December 1 at its plant at Peoria, Ill. Caprolactam is a petrochemical used in producing nylon 6, a new plastic used to make molding resins, extrusion compounds, tire cords, synthetic fibers for floor coverings, and other textile products.

Dow Chemical Co. has increased production capacity of methyl chloride and methylene chloride at its Freeport, Tex., plant by about 20%. The two chemicals are produced in the carbon tetrachloride plant by combining chlorine and natural gas.

El Paso Natural Gas Products Co. has purchased the properties of Duke City Oil Co. and Valley Oil, Inc., two Albuquerque-based gasoline distributors. Both firms were owned by D. K. Lord, C. R. Scott, and Phillip Scott of Albuquerque. El Paso will convert the new properties to El Paso-Dixie stations.

Imperial Chemical Industries, Ltd., plans a 30,000,000-lb. per year expansion of its terephthalic-acid plant at the company's giant Wilton works in England. The project will double output of the acid used in production of "Terylene" polyester fiber and "Melinex" polyester film. Scientific Design Co., Inc., will perform complete design and engineering services for the job in the United States.

A 4,000-bbl. alkylation unit is the latest facility to open at British Petroleum Co.'s expanding Kent refinery on the Isle of Grain, England. Crude throughput at the refinery is now over 144,000 bbl. per calendar day.

Also for Refiners . . .

IN THE NEWS: Refiners have moved into aromatics in such a big way they have made oil the chief source of supply, replacing coal (p. 44) . . . Polypropylene gets a big boost with announcement that Humble plans new processing unit at Baytown. The product will be marketed by Enjay (p. 50) . . . Imports control program has been upheld in court. An injunction sought by Eastern States has been denied (p. 50) . . . First steps have been taken in merger of OCAW and ICW unions (p. 54) . . . Domestic producers have opened a new drive for across-the-board controls over oil imports (p. 56) . . . Getty posts record low price for heavy Neutral Zone crude (p. 66).

PLUS THESE TECHNICAL REPORTS: Planning is vital when designing ethylene storage and distribution (p. 80) . . . How to determine chlorides in the charge to a catalytic reformer (p. 94) . . . Refinery construction survey (p. 100).

Navy Forcing Subsidence Showdown

• Los Angeles federal court asked to order Wilmington field operators to come up with plan to halt sinking or shut in field's production. Navy also may seek $200 million in damages to its facilities.

AFTER A YEAR of barking at Wilmington field operators, the Navy bit last week.

It made a dramatic court move to force oil men to halt subsidence around the big California naval base or shut down their 90,000-bbl. daily production in the field.

The Department of Justice, at the Navy's request, filed suit in Los Angeles federal court. The suit asked the court to:

. . . Order Wilmington operators to come up with a field-wide repressuring program within 60 days or shut down the field.

. . . Award the Government damages which could exceed $200 million for probable loss and replacement of facilities in the field. These include the $170 million Long Beach Navy Base.

Defendants in the suit were the State of California, the cities of Long Beach and Los Angeles, and 395 present or former operators in the field. Large producers involved include Union Pacific Railroad Co., Long Beach Oil Development Co., Richfield Oil Corp., Hancock Oil Co., and the General Petroleum Corp.

Basis of suit . . . The Government charged the operators have failed to take proper action to correct the ground sinking which has been a matter of grave concern for a number of years.

The suit indicates the Government doubts that a law passed by the California legislature last spring will do the job. The measure is unlikely to provide all the steps necessary as soon as they are needed, the court was told.

The Government based its claim for damages on subsidence of the naval shipyard, built at a cost of $75 million but estimated as costing $170 million to replace. No actual amount of damages was specified in the suit, which was filed by U. S. Atty. Laughlin E. Waters.

The Government claimed the Navy base at Long Beach is virtually irreplaceable and strategically vital to the nation's defense.

Waters pointed out the base is the only one on the Pacific Coast which fronts on the Pacific Ocean itself. Bases at San Diego, San Francisco, Portland, and Seattle are in bays or well inland from the ocean proper.

The yard originally was 14 ft. above mean lower low water and 6 ft. above high tide. It is now below the high-tide mark and much of it is below the mean lower low water, the complaint stated.

Subsidence in the yard ranges from 2 to 22 ft. It is continuing at a rate ranging from two-tenths of a foot to more than 1 ft. a year. If subsidence reaches a depth of over 23 ft. in the waterfront area, the yard will become unusable, the complaint stated.

The suit further declared that Navy personnel and employes are in constant danger working behind dikes which the Navy has built at a cost of $7.5 million under a 10-year, $30-million repair program.

At the current congressional session, Navy efforts to get additional subsidence-repair funds hit a snag. It was only last week, after a month-long battle, that the Senate agreed to a $6-million appropriation for Navy base repair funds. The House had slashed the $6-million request to only $500,000 earlier this year.

These are strictly repair funds for subsidence-damaged facilities, not anti-subsidence funds directly. The Senate put a proviso on the funds whereby they can't be spent without prior approval of the Secretary of Navy, who must be satisfied operators and the city of Long Beach are taking effective antisubsidence steps.

Government plan . . . In its suit, the Government specifically asked the court to approve a three-point course of action to halt the subsidence danger.

Under the plan the court would:

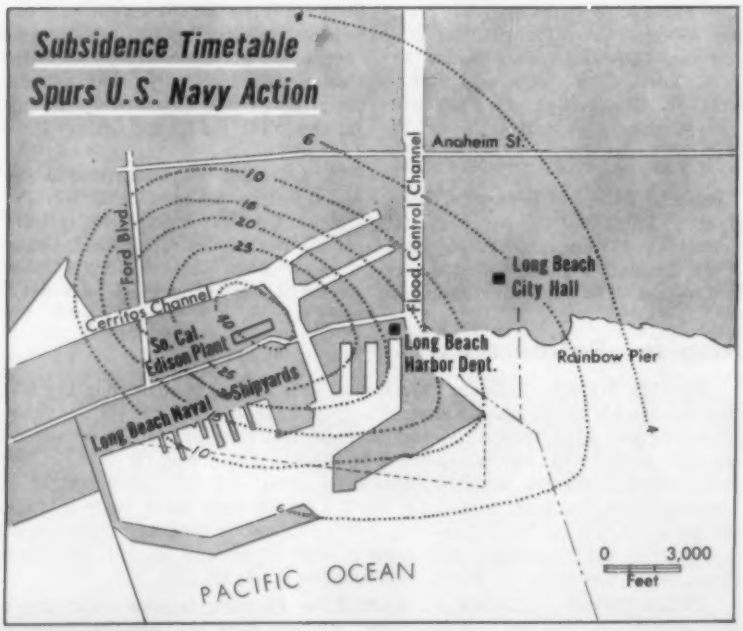
. . . Set up a group representing the present producers, the Government, and the court to prepare a plan for repressuring the field.

. . . Require the group to present a satisfactory plan within 60 days.

. . . Order the defendants then to take immediate steps to carry out the plan.

But if a proper plan is not submitted within the time given, or if the operators fail to carry one out, the Government asked an order shutting in all production of oil and gas from Wilmington until action is taken to abate subsidence.

The Government suggested that additional subsidence can be slowed



PREDICTED SHAPE and contour of sunken bowl at Long Beach in 1977 is mapped above. Figures on contour lines show depth of bowl provided nothing is done to halt subsidence within the next 19 years.

and finally halted by water injection if all operators act under a carefully designed plan. They might even show a profit on the operation, according to the department.

The department said "well-informed experts" have estimated an additional 400 million barrels of oil can be recovered in Wilmington with a secondary-recovery program.

Unusual situation . . . Justice Department officials termed the Wilmington field "almost unique."

The only other field in the world known to be causing subsidence on anything like the same scale is at Lake Maracaibo in Venezuela, they reported. But that field doesn't underlie a thickly populated metropolitan area.

The Wilmington field was discovered in 1932. By the end of last year, the department's complaint recites, 2,921 wells were in operation and total output had reached 799.8 million barrels of oil and 706 billion cubic feet of natural gas, together with more than 200 million barrels of water.

The federal Government acquired 105 acres of land within the field in 1940 and built a number of major facilities during World War II, including the shipyard.

Plans under way . . . The lawsuit is the latest in a series of important events this year affecting the Wilmington field subsidence problem.

Even before this, a battery of consultants has been actively engaged in working up repressuring programs for the field.

Virtually every major oil company active in California is involved at Wilmington. They've had their engineering departments working at full speed on repressuring projects. The net results to date are pretty impressive, considering the time and the number of operators involved.

Within recent weeks, unit agreements have been signed covering operations in fault Blocks 2 and 3. And the city has indicated it will approve a unit program for fault Block 6, which was presented to it only several days ago.

Long Beach Oil Development Co. has launched an ambitious repressuring program on its Long Beach-owned portions of the field. A 170,000-bbl. daily flood is the goal.

The eventual goal is complete unitization of the field with an accompanying 1,000,000-bbl. daily water flood. This size flood has been recommended by engineers as the minimum necessary to build up pressures in the field sufficient to stop the sinking.

watching WASHINGTON

Bertram F. Linz

• Probers will be busy between sessions

A CONGRESS which has just wound up one session already is looking ahead to the next.

Between now and January a number of investigations will be started, aiming at new laws next year. The spadework for some will begin soon. But for the most part, public hearings will come after the November elections.

None of the inquiries now being staged will aim directly at oil or gas. But several will be of interest to the industry.

A rundown of the dozen or more scheduled studies reveals some of the subjects Congress may be asked to deal with in 1959: User charges for highway trucks, steel price increases, red influence in big unions, and campaign contributions by unions and management.

And, of course, the House commerce subcommittee probing industry influence on regulatory agencies is due to get around to the Federal Power Commission before the end of the year.

• Oil needs a voice on study commission

A 3-YEAR STUDY on the use of the Government's recreational lands will start shortly. The oil industry has a stake in the study.

Some time around September 1961 a National Outdoor Resources Review Commission will submit recommendations on the handling of the national parks, refuges, and other sport and play areas.

The commission will consist of eight congressmen and seven members representing the public. Oil men fervently hope that the latter will include a member of the industry.

Unless an oil man is in the group to be named next month, it is feared no voice will be raised against closing more public lands to oil development. Such closing undoubtedly will be urged by conservationists as the commission studies its problem.

Interior Sec. Fred A. Seaton has succeeded in putting a fence around large areas of game and wildlife preserves, defying Wyoming Sen. Joseph C. O'Mahoney in the process. Unless O'Mahoney presses his fight against the rules announced last December, additional areas might well be set aside as a result of the outdoor resources study.

• Unemployment goes on after recessions

CONTINUING large-scale unemployment may be a brake on economic recovery. But it will only be history repeating itself.

The seeming paradox of rising output and continued joblessness was noted following the recessions of 1949 and 1954.

The answer, however, is simple. During recessions, as well as during booms, improved machines and methods are constantly raising worker productivity. And plants that cut the workweek as business falls off will restore normal hours before adding workers.

Economists, in and out of the Government, agree that unemployment will be heavy next winter. The only point of difference is how heavy it will be.

A government report estimates there will be about 3.5 million insured workers out of jobs next January or February, as against 2.6 million last month.

A congressional study concludes that 5 to 5.5 million workers may be idle at that time, and the number could run to 7 million.

And a survey of a large number of leading economists shows a general belief that 4.2 million people will still be out of work at the end of 1959.

Union Merger Started

. . . by OCAW and Chemical Workers. Rank and file members will get chance to approve plans this fall.

MACHINERY has been set in motion to merge the Oil, Chemical and Atomic Workers International Union and the International Chemical Workers Union.

Affiliation of the two groups will bring together two-thirds of the nation's organized workers in the chemical industry—105,000 represented by the Denver-headquartered OCAW and more than 90,000 under jurisdiction of the ICW of Akron, Ohio.

In addition OCAW has about 105,000 members employed in the oil industry.

Initial step in the merger has been taken by top officers of the two unions who held a recent 2-day meeting in Cleveland. Delegations headed by OCAW President O. A. Knight and ICW President Walter Mitchell drafted a definite timetable of preparations for the eventual merger. Details of the plan were not disclosed.

The program was referred to committees and policy-making groups of the two unions for consideration before it is submitted to separate conventions this fall. OCAW's convention opens September 22 in Long Beach and the ICW in Washington starting October 6. A final decision on the merger will be made by rank and file members of both unions.

The two organizations have been cooperating since the AFL-CIO merger in the fall of 1955 by devising uniform contract proposals and policy.

Union costs up . . . The merger comes at a time when Knight's union is losing members through layoffs and is encountering stiff competition from other unions in nearly every organizing drive attempted.

The immediate upshot will be an attempt to increase union dues. Knight reportedly will ask OCAW convention delegates for the higher assessments to provide, among other things, establishment of a strong organizing program.

Increased dues will be asked in three proposed constitutional amendments which must be approved by a two-thirds vote by convention delegates to become effective.

One amendment will provide that local union dues be hiked from the present $3-$6 monthly to $5-$8, effective next January 1. The exact dues between the minimum and maximum would be fixed by local units.

Another amendment would increase per capita payments to the international from the current $1.50 to $2.50 a month.

The third amendment would allot $1.95 of the per capita to the general fund, 50 cents to the defense fund, and 5 cents to the convention fund. The present $1.50 per capita provides $1.32 for the general fund, 15 cents to the defense fund and 3 cents to the convention fund.

Knight said a larger defense fund would permit payments of $25 weekly to strikers, instead of $10.

Knight said employers have stiffened their resistance to union demands in negotiations this year. He added, however, this is only part of a new management approach to its dealings with labor, explaining:

"The employers are spending more time and energy to oppose the efforts of our union. Where a few years ago plant managers might carry on negotiations, today batteries of experts in the fields of industrial relations, psychology, law, research, and public opinion contest our every effort. We shall be forced to increase our own force of experts to meet this opposition."

Trouble in Canada . . . OCAW locals in Saskatchewan are deadlocked with refiners on the wage issue.

Union members have struck Northern Petroleum Corp.'s refinery at Kamsack after failing to reach an agreement on pay increases. The Moose Jaw OCAW local also has set up strike committees for plants of both British American Oil Co., Ltd., and Husky Oil & Refining, Ltd. Management in both cases have declined to consider wage increases.

Meanwhile, OCAW has lost a NLRB election at American Oil Co.'s Yorktown, Va., refinery. The vote was 117 to 74 in favor of the Independent Oil Workers of Virginia. The independent has been bargaining agent at the plant since its opening 3 years ago.

U. S. Opposes Moving Trial

THE JUSTICE Department is fighting oil-company efforts to have trial of the Alexandria (Va.) price-fixing case moved to Tulsa.

The department filed a brief opposing the motion last week. It told the Alexandria federal court that 17 of the 29 defendants' main offices are closer to Washington than to Tulsa.

A change of venue would require the movement of thousands of documents and slow down preparation and trial of the case, the court was told.

"Transfer of this proceeding to Tulsa would necessarily and seriously impede and delay the trial," the department argued.

The government also has replied to defense motions seeking bills of particulars and challenging the make-up of the grand jury which returned the indictment. All motions are expected to be argued next month, paving the way for rulings.

PIPELINE BRIEFS . . .

Pacific Gas & Electric Co. has started deliveries of natural gas through its recently completed $11.5 million 163-mile, 12-in. line from Corning in the north Sacramento Valley to Humboldt County on the north California coast. Initial deliveries will be at the rate of 21 million cubic feet daily.

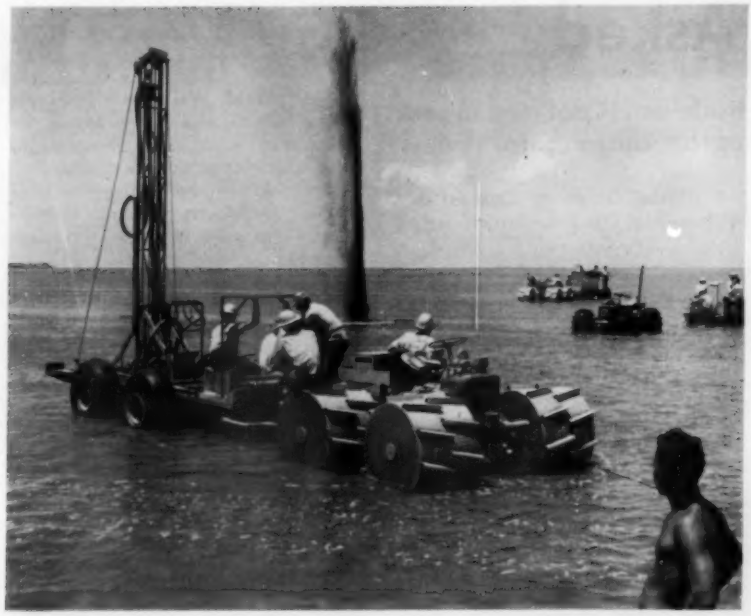
While other industries were faced with cutbacks, the natural-gas industry forged ahead during the 12 months ending in June. Reports of 41 companies to the Federal Power Commission showed gas operating revenues up 15.2%. Gross income rose 16% and net income 13.9%.

Gas sales totaled 8.4 trillion cubic feet, compared with 7.75 trillion the preceding 12 months. Operating revenues totaled $2.61 billion, compared with $2.27 billion the prior year. Cost of gas, however, rose 15.5%, up from $1.16 billion to $1.34 billion.

West Emerald Pipe Line Corp. has started operating the Amarillo-Tucumcari, N. M., section of its new products pipeline. The line is being extended to Albuquerque and will be 300 miles of 6-in. when completed about October 1.

West Emerald is owned two-thirds by Shamrock Oil & Gas Corp. and one-third by The Texas Co., with Phillips Petroleum Co., the third shipper, having an option to buy one-third interest.

Sinclair Pipe Line Co. has completed an 81-mile microwave system



SHOOTERS in the Texas tidal flats find . . .

Strange Buggies Conquer Mud

A SHELL OIL CO. seismic party faced an unusual transportation problem when it went to work on the tidal flats along the Gulf Coast of South Texas. The water was too shallow for boats. The bottom was too soft and muddy for trucks.

The strange-looking vehicles shown above solved the problem.

Seismic equipment was mounted on metal trailers with large, under-inflated aircraft tires. Specially designed little tractors, known as "David Buggies," provided the motive power. The buggies are equipped with metal, drum-like wheels, as shown in the foreground, or fat rubber-cleated tires.

Buoyancy and large surface area of the wheels kept them from bogging down in the soft mud.

Trailers shown, front to rear, carry the drill rig, explosives, and seismic instruments, respectively. The crew is watching as water and mud are thrown into the air by a seismic charge.

Gas Bill Opposed

by U. S. on grounds it would confuse state-federal laws.

THE JUSTICE Department last week asked the Senate not to pass a House-approved bill which could sharply modify federal natural-gas regulation.

The bill provides that no federal act could supersede state law on the same matter unless it expressly stated an intent by Congress to occupy the field exclusively or there is a direct conflict between the two.

Many in the industry view the bill as reviving state conservation laws and orders previously held invalid, such as the Kansas minimum gas price order knocked down by the Supreme Court last spring.

This view also is held by Atty. Gen. William P. Rogers, who opposes the retroactive effect of the bill.

Few federal laws expressly preempt the field, Rogers pointed out.

"At the end of a long series of lawsuits it is possible that the courts might construe H.R. 3 as merely declaratory of existing law," he explained. "Thus interpreted, the bill would be a useless piece of legislation producing untold confusion and burdening the courts with a rush of litigation to no avail.

"This is not merely the usual fear of litigation which accompanies all legislation. Usually such fear is as to a single field and is resolved with one or two cases. This bill will provoke litigation at every point of federal-state conflict no matter how ancient and well settled."

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connecting its eastern division headquarters at Marion, Ohio, with Toledo. The RCA-installed system provides five main channels for voice communications, supervisory control, and telemetering. A sixth channel is used to monitor the performance of the system.

Consumers Power Co. and Michigan Gas Storage Co., an affiliate, have completed laying 85 miles of 24 and 26-in. gas line in Michigan. Contractor was Midwestern Constructors, Inc., Tulsa. Consumers built 45 miles of 24-in. from Overisel gas field to Woodbury station and Michigan Gas built 40 miles of 26-in. from Ithaca station to Stevenson Lake junction along its main line from storage.

Trans Mountain Oil Pipe Line Co. delivered 88,041 bbl. daily of crude in July and expects to average 77,500 bbl. daily in August. Deliveries for the first half of 1958 averaged 90,289 bbl. daily, less than half the 183,316 bbl. for the same 1957 period. Reduced demand for crude in the Pacific Northwest was reflected in Trans Mountain's net income decline from $5,629,000 to $348,000 for the first 6 months of the year.

Also for Pipeliners . . .

IN THE NEWS: Little Big Inch conversion to products marks a shift in the supply and distribution pattern between the Gulf Coast and the Ohio Valley (p. 43) . . . Work finally is ready to start on the Texas-Florida gas pipeline. Some construction may start this week (p. 46) . . . Justice Department opposes bill to modify natural-gas regulation on grounds it would confuse state-federal laws (p. 55) . . . Prefabricated towers help a natural-gas pipeline hop the Trinity River (p. 56) . . .

PLUS THESE TECHNICAL REPORTS: Using thin-wall pipe in natural-gas pipelines (p. 68) . . . A complete list of pipeline projects is carried in this issue of the Journal. The list begins on p. 110.

Imports Cuts Asked

. . . by IPAA under amended trade act. Coal men to seek product controls, as whole program comes up for review.

DOMESTIC PRODUCERS have opened a new drive for across-the-board controls on oil imports.

An immediate "reappraisal" of the voluntary program was urged upon Commerce Sec. Sinclair Weeks last week by Russell B. Brown, general counsel of the Independent Petroleum Association of America.

Weeks is chairman of the Cabinet fuels committee which is expected soon to announce a new quota schedule, passing on more than 80 new applicants, whose requests for quotas exceed 660,000 bbl. daily.

Brown's demand for product controls will be backed up shortly by the National Coal Association. The NCA is preparing a new presentation supporting a request for controls on products, particularly residual fuel oil.

The new trade law makes "obvious" the intent of Congress to bring all finished and unfinished products under control, Brown said.

Brown cited a number of factors, other than changes in the law, which make a new deal imperative:

. . . **An "endless stream"** of new requests for quotas indicates a basic weakness of the present system. Only 17 of the more than 80 applicants have any history as importers.

. . . **Violations** of the program threaten its success so long as it provides no effective penalties.

. . . **Product imports** not under control have grown so large as to virtually offset reductions in crude entries. Crude imports in the 3 months ended with July were 230,000 bbl. daily under the level a year ago. But product imports increased 185,000 bbl. daily in the same period.

New record? . . . "Total imports of crude oil and products, actual and scheduled, for the 11 months January through November 1958, will average about 1,600,000 bbl. daily," Brown said.

"Total imports in 1957 averaged 1,570,000 bbl. daily. Thus, under the voluntary program imports have continued to increase rather than decrease.

"Most important, the exploratory, drilling and development activities essential to the maintenance of expanding domestic petroleum supplies are continuing at inadequate levels."

Products can be brought under the program without further action on the part of the Office of Defense and Civilian Mobilization, Brown stated.

The certification that crude imports threatened national security, under which the present program was set up, and the new directive in the trade act give an adequate basis for such action, he said.

No dates have yet been set for hearings on the new applications, which have been piling up since March. But they are expected to be held next month before Capt. M. V. Carson, Jr., program administrator.

New approach? . . . Industry observers believe the flood of new quota requests may force the committee to adopt a new approach to controls.

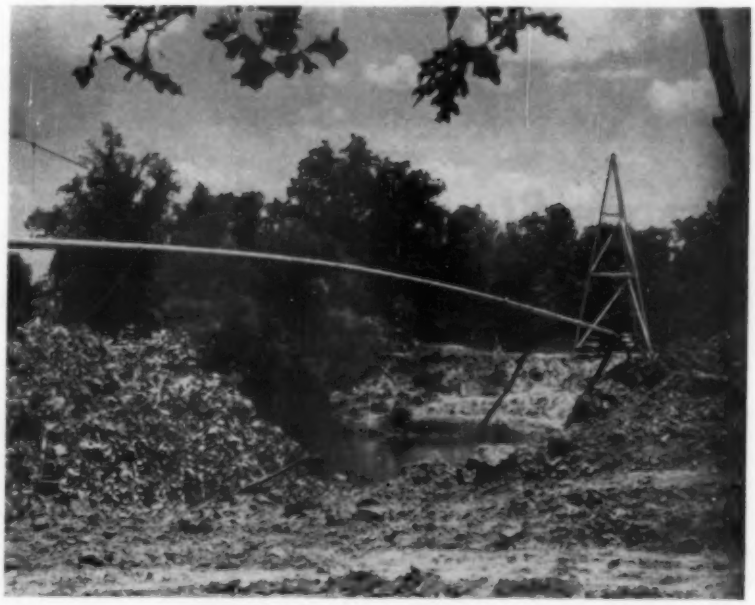
The most frequently suggested plan would give refiners generally a share of the import total, based on their throughput.

These variations have been offered:

. . . **Quotas** could be given to every refiner.

. . . **Quotas** could be parceled out among refiners requesting them.

. . . **Import privileges** could be limited to those refiners who would process foreign oil in their own plants.



PREFABRICATED towers support suspension bridge where . . .

Gas Line Hops Trinity River

PREFABRICATED towers support a 540-ft. pipeline suspension bridge just erected across the Trinity River between Houston and Beaumont.

The 66-ft. towers were manufactured at Dallas and shipped to the crossing in sections to be welded together at the construction site.

The bridge was designed by Clear Span Engineering Co., Inc., Houston, to support an 18-in. natural-gas line in Houston Pipe Line Co.'s system. The overwater line replaces a 12-in. submerged pipe which was damaged during high floods in 1957.

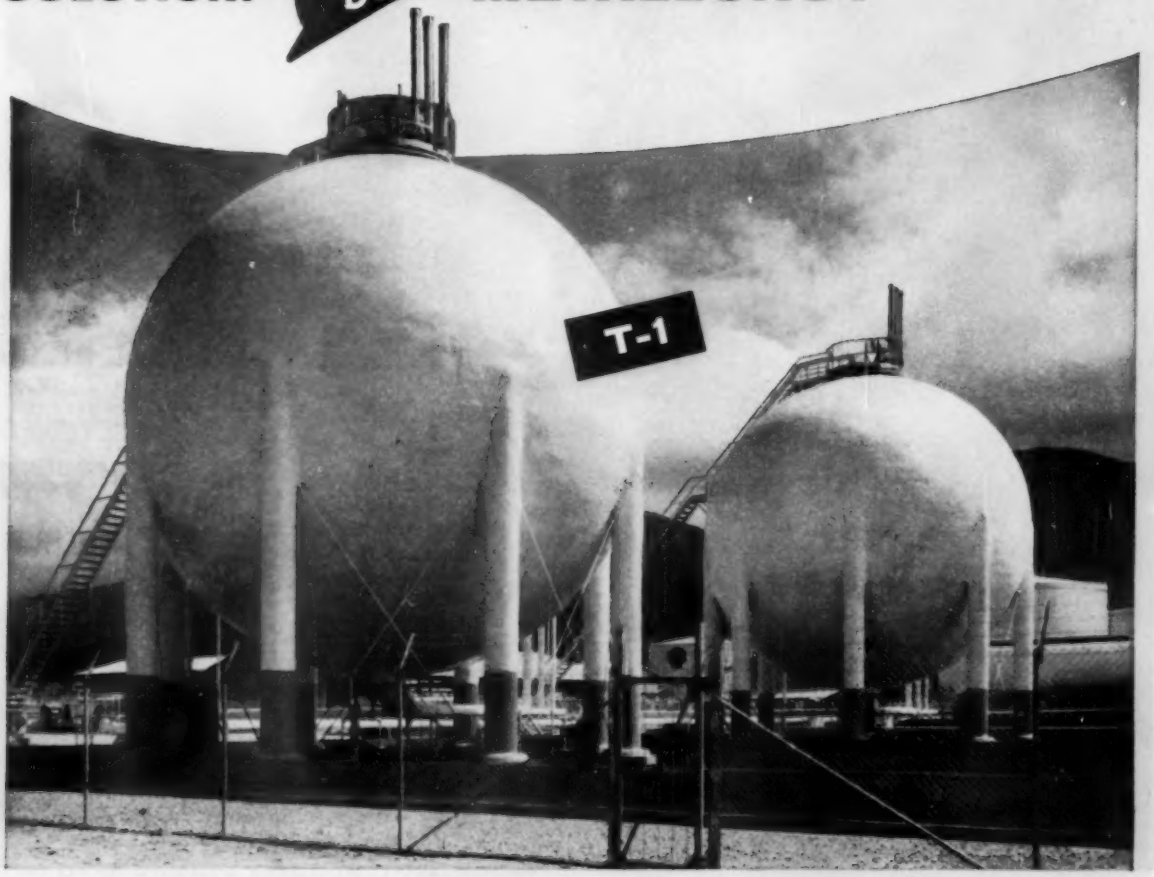
Construction of the crossing required about 3 weeks. The towers remained horizontal, their two front legs hinged to concrete foundations, until the pipe was attached to the 1¾-in. support cable and floated across the river. The line was raised to predetermined position merely by hoisting the towers upright. This operation required about an hour.

The Trinity River bridge, erected by Troy Construction Co., is similar in design to several installed on the Yellowstone Pipe Line Co. system 4 years ago. However, in the past, towers have been constructed at the crossing rather than prefabricated.

Clear Span has been awarded contract for design of a similar but much larger bridge for Eastern Shore Natural Gas Co. It will be a 1,200-ft. crossing of the Chesapeake-Delaware Canal near Wilmington, Del.

PROBLEM: More Propane for Caracas

SOLUTION: METALLURGY



Why 2 HORTONSPHERES® do the work of 20 Tanks

Increased usage of propane in Caracas made it necessary for Compania Shell de Venezuela Ltd. to either (1) add to the company's already crowded bulk storage facilities at *Catia La Mar* or (2) place another tanker in service.

Thanks to CB&I *craftsmanship in steel*, Shell was able to solve its problem without additional shipping expense; and without adding more real estate.

Two 6,900-barrel capacity Hortonspheres, designed by CB&I for 235 lbs. working pressure, were fabricated at our Greenville plant of T-1 steel. The strong alloy made it possible for the two high pressure vessels to store as much propane as 20 smaller, mild steel vessels.

CB&I's practiced knowledge and extensive facilities for designing, fabricating and erecting structures of modern metals made these savings possible. The most complete metallurgical testing facilities, which include X-ray and stress relieving services in shop and field, have made the experienced capabilities of CB&I *in demand* . . . all over the world.

Write our nearest office for details. Ask for the CB&I Bulletin *Special Plate Structures.*

SPECIFICATIONS

2 HORTONSPHERES—Propane Storage

Compania Shell de Venezuela Ltd.

Capacity: 6,900-bbl. each

Pressure: 235 lbs. per sq. inch

Steel: T-1

Diam: 42-ft.

METALLURGICAL CONTROLS

Joint Efficiency—95%

Stress relieved in field

X-rayed 100% in field

Hydrostatic test: 354 lbs. sq. in. (at top of vessel)

Design: In accordance with ASME Code Case #1204-3

Designed, engineered, fabricated by CB&I and erected by our subsidiary CB&I, Ltd.

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Kansas City (Mo.)
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, GREENVILLE, PA. and at NEW CASTLE, DELAWARE.
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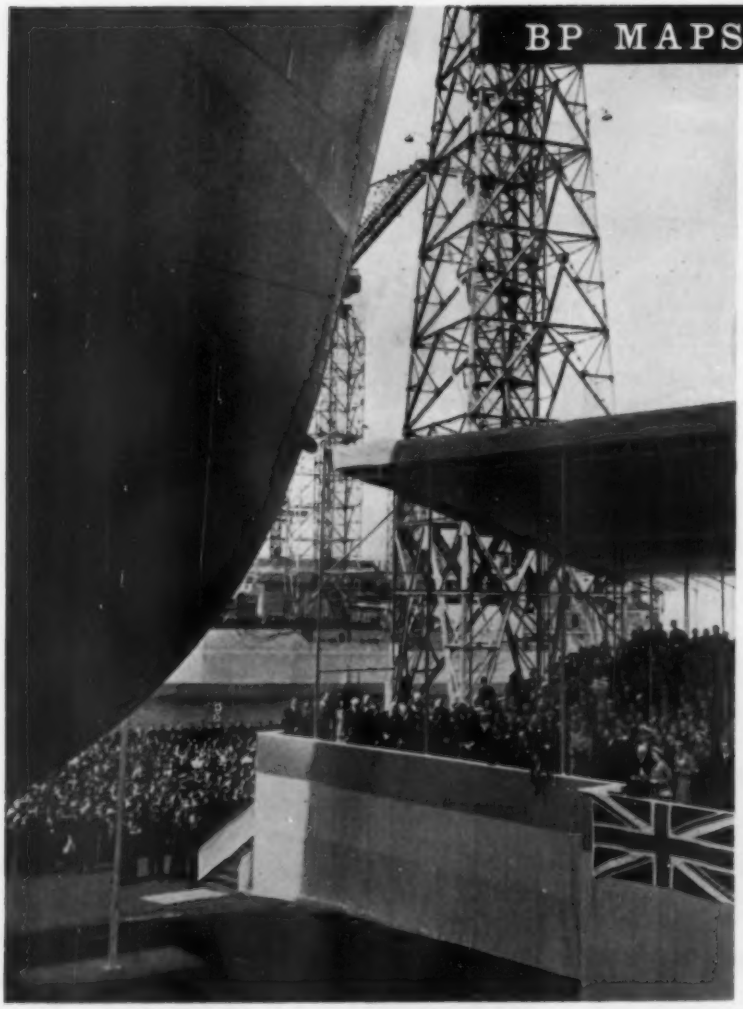
BP MAPS THE FUTURE



There she goes! *H.R.H. The Duchess of Gloucester names her 'British Duchess' and down the slipway and into the Clyde moves the first of BP's 42,000-ton tankers.*

Full steam ahead. *This funnel will be fitted to 'British Duchess' just as soon as they start work on her again; which will be only minutes after she is launched.*

Clydebank's first 42,000-ton tanker

With a roar of hawsers, and a great cheer from the hundreds thronging Clydebank, the first 42,000-ton tanker ever built by a British firm for a British fleet recently slid down the slipway. Launched by H.R.H. The Duchess of Gloucester, her name is—BRITISH DUCHESS.

BUILT by John Brown of Clydebank (they built both the Queen Mary and the Queen Elizabeth) this ship, on order to The BP Tanker Company, is the biggest tanker yet to be built in Britain to sail under the British flag.

Second only to the Queen Mary

The British Duchess is a mighty ship indeed. In fact, as Sir James McNeill, Managing Director of John Brown & Co. said at her launching, "*When she is completed, her displacement tonnage for vessels under the British flag will be second only to the Queen Mary*".

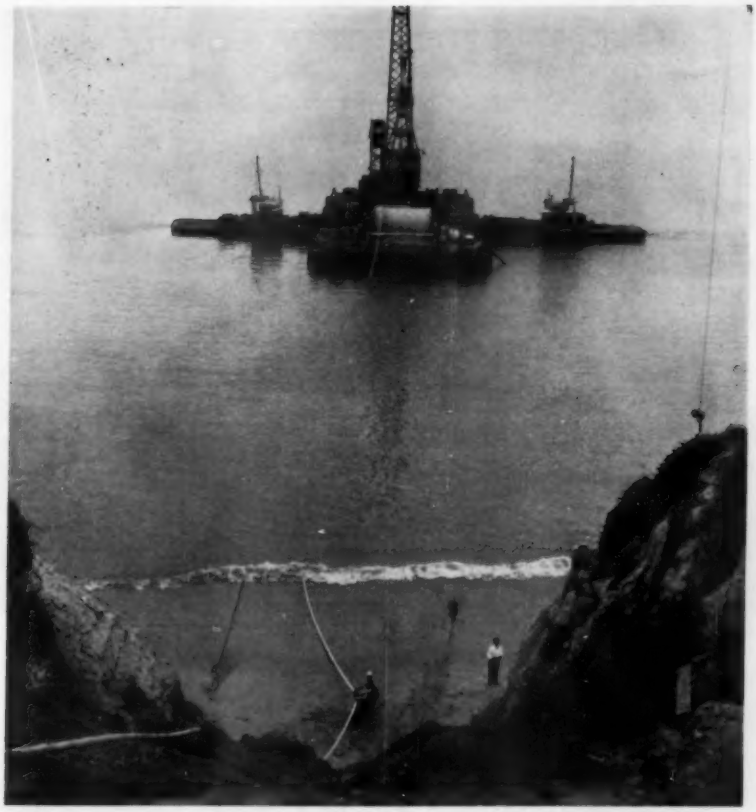
But BP plans far bigger ships than this. Others now building or on order include six 42,000-ton sister ships to the British Duchess, 12 other vessels of 50,000 tons and 7 giants of 65,000 tons.

Oil supplies doubled?

Within the next 10 years Britain may have to double her oil supplies. The British Petroleum Company is making sure that not only is the oil found and brought to the surface and refined, but that there are the ships to carry it. Ships like the British Duchess are even further proof of how confidently BP plans for the future.

THE BRITISH PETROLEUM COMPANY LIMITED

BP



THIS giant cable runs over a cliff and across the beach into California's surf. The barge then unreels it seaward 2½ miles. That's how Socal's . . .

Rig Gets Undersea Power Line

STANDARD Oil Co. of California will get the power for its electrically driven drilling rig off Santa Barbara County from a newly laid cable.

The big 3-in. wire line was manufactured by Okonite Co.'s North Brunswick, N. J., plant and insulated and sheathed with polyethylene.

The 16,500-volt, 3-conductor cable is capable of carrying more than 3,500 KVA, or more than 4,500 hp.

Okonite says it is one of the longest lengths of plastic insulated submarine power cables ever manufactured. Before installation the big reel of cable weighed 55 tons and measured 10½ ft. high, 10½ ft. wide, and 22 ft. long.

The shore end of the cable (photo) terminates atop a high bluff. After being unreeled, it was buried in a 3-ft. trench across the beach and through the surf to a point where the water is 10 ft. deep.

The cable then was laid through heavy kelp beds extending about 1½ miles offshore. From that point it rests on the ocean floor.

The cable setup was installed for California's first permanent offshore drilling platform, erected in 100 ft. of water off Summerland (OGJ, June 23, p. 71). The platform eventually may hold as many as 25 producers on the 5,500-acre lease, held jointly by Socal and Humble Oil & Refining Co. Socal is the operator.

The entire rig operations will be electrically powered.

Supply Loss Hurts Gas Case

NATURAL GAS Pipeline Co. of America does not now have a gas supply sufficient to permit service to two Chicago-area steel firms, it was held last week by Federal Power Commission Examiner Francis L. Hall.

The company's application for authority to serve the steel plants was based on an agreement to buy 460 million cubic feet of gas daily from Colorado Interstate Gas Co. But Colorado canceled the agreement last month, leaving Natural without a firm supply source to back up its request (OGJ, Aug. 11, p. 66).

Hall's decision is subject to review by the commission.

—— *Industry* briefs

Penrod Drilling Co., one of the country's largest drilling contractors, will move its headquarters from Shreveport to Dallas, effective September 1. Penrod now has 28 rigs, 18 of them land-based. The company plans to retain its present office at Houma, La., to handle drilling in South Louisiana and offshore work in the Gulf of Mexico.

The New Mexico Oil Conservation Commission has set the state's September production allowable at 35 bbl. daily per basic unit for southeastern fields and 51 bbl. daily for northwestern fields.

This is the same southeastern allowable but a 1-bbl. reduction in the northwest. The allowables are expected to result in total production of 289,190 bbl. daily in the southeast and 30,824 bbl. daily in the northwest.

Cosden Petroleum Corp., Big Spring, Tex., has exchanged its stock for all the working interest of Tri-Service Drilling Co., Midland, in producing properties in which the two held joint ownership.

The deal covered 12 leases with 16 producing wells in Reagan County, the A. R. Baumann lease in Midland County, and the E. Y. Murphy 160-acre lease in the Reinecke field, Borden County. The purchase added an average 130 bbl. daily production and more than 300,000 bbl. to Cosden's crude-oil reserves.

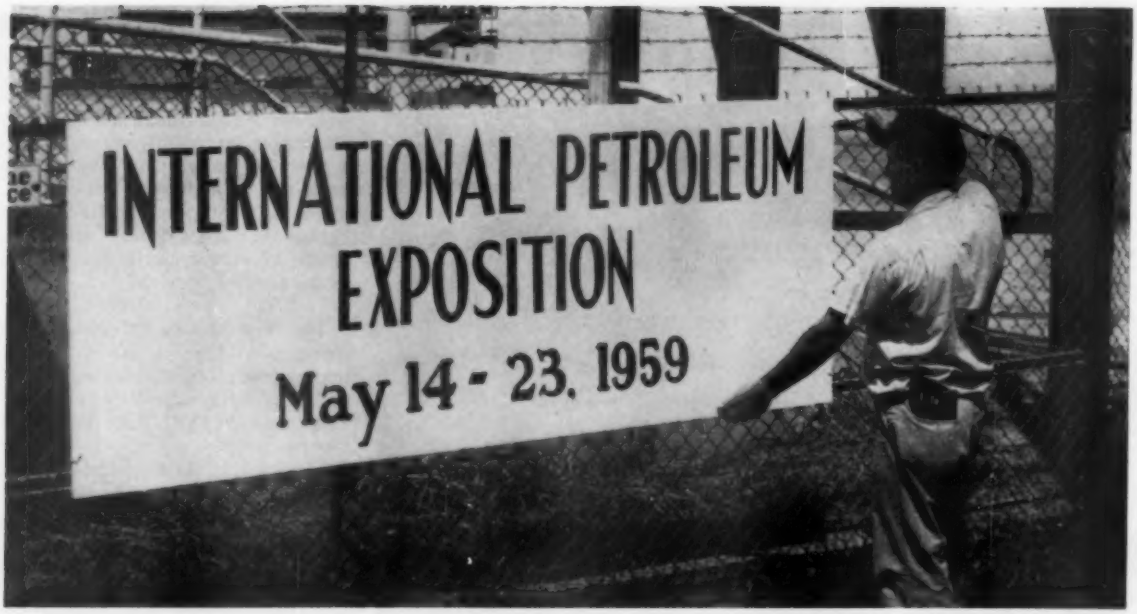
Bandini Petroleum Co. and Hamilton Dome Oil Co., Ltd., both of Los Angeles, jointly have acquired the properties of Wilber J. Cox in Santa Fe Springs field in Southern California. The purchase covers six oil wells with settled production of 100 bbl. daily. Bandini will operate the wells in conjunction with its present operations in the Santa Fe Springs area.

More price cuts have been posted in South Texas and Louisiana.

Sun Oil Co. cut prices 15 cents a barrel in Baskinton, Big Creek, South Big Creek, Bateman Lake, Bayou Blue, Belle Isle, Lake Pelto, and Sweet Bay Lake fields; and 10 cents in Delhi, South Delhi, and West Delhi.

Phillips Petroleum Co. cut 8 cents in Bailey's Prairie, Chocolate Bayou, and Old Ocean fields in Houston area.

Indiana Oil Purchasing Co. cut 5 cents in Colquitt and Mt. Sinai fields in Louisiana.



Next Year's Oil Show: Biggest Yet

OIL will display its technical muscles next year with the most grandiose array of petroleum-industry equipment ever assembled in one spot.

More than a half-billion dollars worth of new equipment and exhibits will be shown off at the fourteenth International Petroleum Exposition in Tulsa, May 14-23.

Literally the "world's fair" of the oil industry, the exposition will be the biggest single event in the 100th anniversary year of the oil industry.

Most exhibit space was snapped up a year in advance, and workmen have been busy for 8 months dressing up exhibit halls and installing electrical equipment. There'll be enough electric power available on the 30-acre grounds to handle normal needs of a city of 55,000 population.

Big attendance . . . A record number of visitors is expected.

More than 30,000 oil men who buy, specify, and use oil equipment and services will be on hand. This is nearly 2,000 more than attended the last show held in 1953.

All oil-producing states and 50 countries will be represented, but the biggest increase in attendance will come from abroad. About 800 foreign visitors attended the last exposition. About 2,000 are expected next year.

For one thing, foreign exploration and development have climbed rapidly the past few years. Equally important, the Fifth World Petroleum Congress will be staged in New York.

Both groups—IPE and World Petroleum Congress — planned it that way. Delegates to the congress can visit the Tulsa exposition before attending their own conferences in New York May 30-June 5. Special tours are being arranged from New York to the oil country.

What to expect . . . Vying for attention will be about 2,000 drilling, producing, exploration, pipelining, refining, and petrochemical exhibits.

This compares with 1,485 exhibits at the 1953 exposition. More land has been acquired to help make room for the greater influx. About 98% of the outdoor space and 96% of the indoor space is already sold.

Permanent buildings on the grounds have already had the first fresh coat of paint. Many exhibitors have turned to air conditioning to take some of the swelter out of the Southwest's warm climate.

One of the biggest attention-getters at the show will be the Hall of Science, which will pinpoint oil progress since the last exposition 6 years earlier.

More than $750,000 worth of models and other exhibits will be on display. This will be a sure-fire attraction to non-oil visitors who want to learn more about oil technology. During the 1953 exposition, the gates showed total attendance at nearly a half million.

Details of the special centennial observance haven't been worked out yet, but a centennial committee is scheduled to meet in Tulsa next month to lay groundwork.

Housing . . . Tulsa's population bulges during the exposition, but housing arrangements already are in full swing.

A citizens' committee formed a housing bureau to handle requests for rooms. More than 3,000 Tulsa families have offered to make their homes available to visitors.

Thus, instead of a room shortage there will actually be a surplus. This is despite the fact that motels still under construction were booked solid well in advance.

For information about housing or exhibits letters should be addressed to IPE, Tulsa, Okla.

IPE has grown with the industry. It started on a much smaller scale in 1923. Long-time president of the executive committee was W. G. Skelly. After Skelly's death last year, W. K. Warren of Warren Petroleum Corp. was named president.

The biggest upsurge in the exposition coincided with the great technical advancements in the industry after World War II. In 1948, about 16,000 oil men came to see the exhibits. In 1953 this climbed to about 28,000. With the new emphasis on technology, the 1959 show is already well on its way to becoming the biggest ever.

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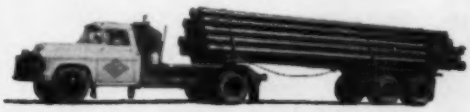

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Russia Eyes Major Oil-Exporter Role

• There has been recent talk of the Soviet Union stepping up oil exports in the future on a large scale as a political weapon in the cold war with the West. Here is a comprehensive report on such possibilities written by an economist for the Atomic Energy Commission.

Ely M. Brandes
AEC Economist

SOVIET RUSSIA'S determined drive for more trade with the West may soon make her one of the world's leading exporters of crude oil, which in turn may lead to considerable friction between the U.S.S.R. and her newly-won friends in the Middle East.

This conclusion is reached after an analysis of a number of interrelated developments which are occurring both inside and outside Russia.

The first link in this chain of evidence, so to speak, is Russia's current success in increasing her supplies of energy resources—particularly oil and natural gas—and her even more ambitious plans for the future.

Russia's oil production, for instance, has increased from 29 million tons* in 1948 to 98 million tons in 1957.

The production of natural gas rose from about 5 billion cubic meters in 1948 to more than 20 billion cubic meters in 1957, with most of the increase occurring during the last 2 years.

Coal production has increased less rapidly during this period, from 208,000,000 tons to 450,000,000 tons.

In addition, Russia's production of hydroelectric power rose from 10 billion KWH to 29 billion KWH.

Bigger goal . . . But these current achievements are dwarfed by the announced plans for future expansion.

While other parts of the current Five or Seven Year Plan are still shrouded in secrecy, the Kremlin recently set a goal of 400 million tons of oil and 300 billion cubic meters of gas to be achieved in 10 to 15 years. To reach these goals, annual increases of roughly 15% and 30% are needed in the production of oil and natural gas, respectively.

With all due skepticism about Russia's statistics and plans, there are indications that these goals are actually attainable. Since World War II Russia has discovered vast new oil and gas fields in the Volga region, in the Urals, and other places.

Production in these fields appears to be more limited by lack of transportation than by anything else. To remedy this situation, Russia has initiated a crash program to build oil and gas pipelines from the producing fields to industrial centers, both in European Russia and Siberia.

Assuming then that the announced plan for oil and gas production can be achieved in 15 years and that coal production will increase by no more than 5% per year—less the current rate—Russia would more than triple her output of energy resources during this period.

Adding together the production of various fuel sources in terms of coal equivalent, Russia's total energy production in 1957 was about 525 million tons of coal equivalent. In 1973 this would be increased to more than 1.6 billion tons, not even counting any nucleur power plants that will be built by that time.

What is so remarkable about these figures is that they seem to be far in excess of what Russia actually needs for her own industrial development.

To double Russia's current industrial production—a likely goal for the next 15 years—would probably require an increase in her fuel consumption of something less than 70% during this period, and not the 200% increase planned.

In the United States, for instance, industrial production increased by more than 115% between 1937 and 1955, yet fuel consumption increased only by about 77%, from about 760 million metric tons coal equivalent to about 1,350,000,000 tons. And even that overstates the actual amount required for increased industrial production because much of the additional fuel was used to power our automobiles, whose number rose from less than 30 million in 1937 to more than 62 million in 1955.

Successful completion of her fuel production program would permit Russia not merely to double her industrial production, but would actually be sufficient for a four to fivefold increase. But such a rate of industrial growth is impossible to achieve, even for Soviet Russia, due to limitation on the supply of other raw materials, and even more importantly due to limitation on manpower.

Russia's leaders, therefore, must have some additional use in mind for this vastly increased supply of fuel.

It is unlikely that Russia is planning to overtake us in the production of passenger automobiles. On one occasion Krushchev has told visitors, rather disdainfully, that he does not regard passenger automobiles as a yardstick for a country's standard of living, and therefore does not foresee the day when every comrade will have a car in his garage.

The answer . . . What then will Russia do with all this fuel? The likely answer is that she will export large quantities of oil, and perhaps even coal, to pay for her growing imports from the West.

In recent discussions about Russia's increasing trade with the West, too little attention has been given to the fact that the Soviet Union at present has very few commodities which are desired by the West and which could be used in payment for all the machinery and equipment Russia seeks to buy.

This was probably the reason why Khrushchev, in his recent letter to President Eisenhower, suggested an extension of credit, recognizing that the U. S. has little need for the materials which Russia can export at present.

Russia's traditional exports to the West are furs, chrome and manganese ore, timber, and perhaps limited quantities of pulp and paper products. Demand for these products here and in western Europe simply does not add up to the hundreds of millions of dollars required for large scale, balanced trade.

Russia used to export considerable

*One million tons of 36°-gravity crude is equal to 7,454,000 bbl.

quantities of grain, but prospects here have been practically eliminated by Khrushchev's agricultural policies.

As far as wheat is concerned, the shift of the wheat producing center from the Ukraine to the drought-threatened virgin lands of Kazakhstan has made Russia's wheat supply, if not smaller on the average, at least less dependable from year to year (Khrushchev, himself, has said that his virgin lands scheme would be a success if only two out of five harvests produced bumper crops). And without a dependable annual surplus it is difficult to enter into long-term export commitments.

In the past, the Soviet Union also exported fair quantities of feed grains, like oats and barley, but such exports will undoubtedly become victims of the current campaign to catch up and surpass the U. S. in the production of meat and milk.

Recently, Russia added metals, such as tin, aluminum, zinc, platinum, to its list of exportable items, selling some quantities to the West at below world market prices.

Many of these sales brought immediate cries of "dumping" from western producers. The British Board of Trade, for instance, is currently engaged in an investigation to determine whether Russian sales of aluminum to England actually constituted dumping. In view of these protests, it is doubtful whether Russian can expand these metal exports to the West much further.

As far as Russian machinery and equipment are concerned, there is simply no demand for them here or in western Europe.

The best evidence of Russia's current inability to pay for western imports with exports of her own are the large gold shipments which the Soviet Union has been making regularly over the past 3 years. It has been estimated that these shipments, mostly to Switzerland and London, have involved more than $200 million worth of gold.

It is clear, therefore, that if the Soviet Union wishes to increase her imports from the West she must find a trade medium which is readily saleable in the West and which can bring in revenues running into the hundreds, instead of tens of millions of dollars.

That leaves oil . . . It looks as if this trade medium will be oil.

The Soviet Union has already started to export crude oil, though the quantities involved are still small. During the height of the Suez crisis, the Soviet Union concluded a trade agreement with France, for instance, involving the shipment of some 2 million tons of crude oil.

The recent trade agreement with western Germany also listed crude oil as one of Russia's exports. And a few weeks ago Russia offered Brazil an agreement to barter oil in exchange for coffee, cocoa, and cotton.

Even more recently, the Soviet Union sold 1 million tons of crude oil to Argentina against competition from the Middle East and Venezuela. Finland is said to receive at present most of her crude oil from Russia, and that is also true of Russia's European satellites.

Russian foreign trade statistics are hard to come by, but it has been estimated that her oil exports are currently at an annual rate of approximately 5 million metric tons. (For comparison purposes, oil exports from the Middle East last year involved some 160 million tons).

One bit of evidence indicating that Russia's oil exports may soon jump upward was recently revealed by CIA Director Allen Dulles. In a speech about Russia's economic progress he noted that one of the many pipelines under construction there is a line from the Volga oil fields to Leningrad. The completion of this line will undoubtedly permit Russia to increase greatly her oil shipment to the West.

Assuming that Russia's fuel expansion program comes close to staying on schedule, it is quite possible that her oil exports may reach an annual rate of 50 million tons within the next 5 to 10 years. And 50 million tons of oil are worth between $750 million and $1 billion.

Market problems? . . . What are the Soviet Union's chances of selling all this oil in western Europe, Asia, and South America?

They are frankly quite good, because oil purchases from Russia offer a number of undeniable advantages to western buyers:

. . . **Russian oil** can be bought on a barter basis, without spending hard currency. In contrast Middle Eastern oil must generally be paid for in scarce dollars and other convertible currencies.

. . . **Russia in the past** has not been averse to making price concessions, and in an item like oil, this can amount to a nice bit of change.

. . . **While dependence** on the Soviet Union for the supply of oil is nothing to be desired in itself, it is probably no worse than dependence on an oil supply controlled by Colonel Nasser.

Russia might experience some opposition in her export drive from the big companies, though it is doubtful resistance will be too great.

First, the loss by the oil companies will only be a partial one as they will still share in refining and distribution of Russian crude oil. Second, even if they planned resistance through price cutting, Russia, with her ability to disregard costs, would undoubtedly be able to match cut for cut.

The big losers would be the oil producing countries of the Middle East, like Saudi Arabia, Iran, Iraq, and Kuwait, and Colonel Nasser, through whose Suez Canal most of the Middle East oil flows.

In spite of the phenomenal growth of oil production in the Middle East —from 56 million in 1948 to 175 million metric tons in 1957—and the even greater increase in oil royalties through revisions in the profit sharing agreements, these countries are far from satisfied with their present oil revenues.

They complain bitterly that the big oil companies, like Standard Oil Co. (N. J.), The Texas Co., Standard Oil Co. (Calif.), Royal Dutch-Shell, and British Petroleum Co., Ltd., who control most of the oil concessions there, are not expanding production fast enough.

These claims are difficult to verify, but just in the last few years Kuwait, Saudi Arabia, and Iran have succeed-

THE AUTHOR . . .

BRANDES is an economist for the Atomic Energy Commission. Born in Vienna, Austria, he came to the United States in 1939. He has an AB degree from Birmingham Southern College and an MA degree from Harvard University.

He was an economist in the national production authority, Department of Commerce, from 1951 to 1953, and for Tennessee Valley Authority, 1953 to 1956. He has been with AEC since 1956.

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ed in finding additional concessionaries for oil lands not yet developed, and under profit-sharing agreements which are often better than the traditional 50-50 split.

Included among these are Standard Oil Co. (Ind.), and for the first time, Italian and Japanese companies. But these plans for increased oil production in the Middle East stand little chance of realization if Russia enters the picture as a major oil exporter.

Foreign policy . . . It is not difficult to predict what some of the political consequencies of such trade competition might be.

Thus far Soviet Russia has been trying to establish a reputation in the Middle East as a gracious benefactor, whose gospel of trade and aid helps all and hurts none. And by her willingness to do the things which other countries refused to do, like shipping weapons to Egypt and Syria, and paving roads in Afghanistan, she has nearly succeeded in that. It remains to be seen whether she can maintain that reputation in the competitive battle which is bound to ensue.

It will also be interesting to see what the attitude of our Government will be in all this. Some of our officials will undoubtedly claim that increasing Russia oil exports are further evidence that we are losing the economic cold war, but actually such a pessimistic view is hardly warranted.

True, we can do very little to prevent Russia from selling her oil abroad and enjoying the financial benefits which such sales will bring. But this is no more than a realistic recognition that the policy of blockading Russian trade will be as ineffective in the future as it has been in the past. Russia's natural wealth and growing productive capacity are facts that cannot be waved away by a change in our foreign policy.

But Russia's sale of oil to the West, even in large quantities, will not by itself lead to economic dependence of the West on Russia and cause the destruction of our alliances.

There is every indcation that during the next 10 to 20 years, if large-scale Russian exports materialize and oil from the Sahara begins to flow in quantity, the world may experience a real oversupply of oil.

And in a buyer's market, it is the seller who is dependent on the customer and not the other way around. Besides, the spectacle of Russia trying to explain to Colonel Nasser that he will be better off if less oil flows through the Suez Canal should be worth something to our State Department.

The JOURNAL Said . . .

50 years ago

August 20, 1908

A water well being drilled on the A. S. Gage pasture near Alpine, Tex., and 8 miles from Marathon, encountered gas at about 60 ft., with a showing of oil. The Marathon Oil & Development Co. has been prospecting not far from this well.

Kansas City has demonstrated that the cost of oiling roads is less than the cost of sprinkling.

Gulf Coast production on August 15 was put at 46,615 bbl., Southwest Texas being credited with 30,495 bbl., and Louisiana 16,120 bbl. These figures indicate a falling off in aggregate output of 3,443 bbl. compared with the July 31 estimate.

25 years ago

August 24, 1933

A new petroleum code has been approved by President Roosevelt and will go into effect September 2. The oil industry, like others, has been awaiting its code very much as if it were Judgment Day. The first thing we need to realize is that the code is not going to be eternal.

Plans for the organization of a new company to take over the operations of the Standard Oil Co. of New Jersey and the Socony-Vacuum Corp. in the Far East are expected to be announced before the end of the month. It is reported that the new company will have a capitalization of $100,000,000 with all the stock held by the two companies and the management in charge of officers obtained from the two companies.

10 years ago

August 26, 1948

The National Security Resources Board is making a study of the vulnerability of the oil industry to enemy attack and is expected to come up in the near future with some suggestions for the dispersion of refineries and storage facilities . . . The best location for plants would appear to be in areas where the industry concentration covers less than 5 sq. miles or with a population of less than 50,000, separated by about 10 miles of relatively open country or by hills. . . .

In the Rocky Mountain region and elsewhere in the world where rock exposures occur at the surface, aerial photographs are providing an extensive panorama for assistance in the location of oil structures.

Even if the federal Government ultimately gains control of offshore lands in the Gulf of Mexico, there is every reason to hope that leases granted by the state will continue valid, B. A. Hardey, chairman of the Louisiana State Mineral Board, said last week.

French Seek Argentine Deal

. . . involving big drilling and refining program. Another American drilling contractor makes new offer to YPF.

MORE companies are showing an interest in doing development work for the Argentine state oil agency on a contract basis.

Two French groups have submitted a joint letter of intent to Yacimientos Petroliferos Fiscales to spend $70 million for exploration, production, and refinery expansion. They are Bureau de Recherches de Petrole and M. Schneider Enterprises.

The letter calls for a $5-million exploration and a $20-million drilling program on areas to be picked by YPF. Fifty wells would be drilled the first year using five French-built rigs. The rigs and other oil-field equipment would cost another $10 million.

The remaining $35 million is intended for expansion of San Lorenzo refinery.

Southeastern makes offer . . . Another United States drilling firm also has expressed interest in an Argentine contract. Southeastern Drilling Corp., Dallas, has offered to drill on sites selected by YPF with a sliding-scale payment depending on production.

Sea Drilling Corp. and Lane-Wells Co. are already negotiating drilling deals with YPF. Laughlin-Porter Drilling Co. expects to ship two rigs to Tierra del Fuego soon on a contract tied down last year (OGJ, Aug. 4, p. 70).

YPF has already pinned down two contracts for development work without at the same time granting concessions. Carl M. Loeb, Rhoades & Co., however, has agreed to a revision of certain clauses which will give YPF authority to designate suppliers and the final word in the joint operations committee. The government had asked the changes in agreement because of local political pressure (OGJ, Aug. 18, p. 126).

Pan American International (Indiana Standard) has a firm contract for a $60-million program. The deal gives Pan Am preference on sale of foreign crude to YPF after 3 years.

Low Middle East Price Posted

. . . by Getty for low-gravity Neutral Zone crude. Initial listing by comparative newcomer may be world's lowest.

ESTABLISHED offtaker companies in the Middle East appeared unworried last week over low initial prices posted by Getty Oil Co. for Middle East crude.

Getty Oil pegged Burghan crude at $1.61 per barrel for 23.5° to 24.4° gravity. This is about 13 cents per barrel below the cost of Safaniya crude, allowing 2 cents per barrel adjustment for each degree change in gravity.

The company lists 20.5° to 21.4° gravity Eocene-Ratawi crude at $1.43 per barrel. This is probably the lowest posted price for any crude in the world today.

But the new postings created no immediate ripple around the Persian Gulf. This was a sign the prices are close to the level at which relatively low-quality Neutral Zone crude was already moving.

Middle East competitors nevertheless were speculating as to the reason Getty Oil posted prices at this particular time. Because Getty Oil is a comparative newcomer struggling to find a market for new foreign crude supplies, its marketing moves take on significance.

One of the leading industry questions is what steps Getty Oil and other foreign newcomers, such as in Venezuela, can or will take to recoup their investments to develop foreign production — especially with import restrictions limiting the crude they can bring home to their U. S. refineries.

Getty Oil has no U. S. refinery of its own. But affiliated Tidewater Oil Co. is smarting under a profit decline due in part to a limit on the Neutral Zone crude it can bring into its new 120,000-bbl. Delaware refinery. Tidewater's net of $279,000 the first half of this year was down from a $21.5-million profit in the same period last year.

Safaniya price . . . Burghan oil is in some respects comparable to Safaniya crude, although not in every way.

Besides lying close together geographically, both fields produce comparable heavy crude with a high sulfur content of more than 3%.

Safaniya has found its price level in competition with other Middle East crudes at $1.79 per barrel for 27° to 27.9°-gravity crude. This price f.o.b. Ras Tanura is posted by all four offtaker companies, which are affiliates of parent companies of Arabian American Oil Co. Along with other Persian Gulf offtakers, they did not immediately budge.

Getty Oil has been producing around 35,000 bbl. daily, as its share of Neutral Zone production. It holds the concession over Saudi Arabia's undivided half interest in the Neutral Zone. Its tanker terminal is in the Neutral Zone itself. American Independent Oil Co. with a concession over Kuwait's undivided half interest, exports crude from Mina Abdullah, Kuwait.

Oil-Finding Theory Is Pushed

A NOVEL exploration theory could get its first tryout in Puerto Rico if a recommendation by a geologist for the U. S. Geological Survey can win support.

The theory is the radioactive halo thesis first put forward 6 years ago by Hans Lundberg of Toronto (OGJ, Apr. 30, 1956, p. 192). He suggested that a halo of radioactivity surrounds many oil fields.

The theory has not been generally accepted by geologists and geophysicists. Another study of Lundberg's data for Redwater field in Alberta and Coalinga field, California, suggested that features other than the oil fields accounted for radioactive anomalies.

But the theory is not forgotten. A general survey of regional radioactivity in the central part of Puerto Rico's northern coastal plain turned up a zone of abnormal radioactivity less than 1 mile from a small anticline lying to the north of a fault. Rocks show no measurable uranium.

The known geology would not make the anticline a particularly tempting drilling prospect. The structure itself, known as Quebrada Arenas anticline, is small. The anticline at the surface appears to have a closure of about 130 ft. toward the south, and 65 ft. toward the southeast and southwest.

Besides being small, the potential reservoir rocks are thin, possibly from 1,150 to 1,300 ft. thick.

The radioactivity anamoly, however, in connection with the anticline and fault made Watson H. Monroe, chief of the Geological Survey in Puerto Rico, recommend that the situation be called to the attention of oil companies.

His report pointed out that the zone of radiation might have several other explanations. But on the favorable side, there is a concentration of sand in the Tertiary rocks at the surface, suitable for reservoir-type rock. A 1,200-ft. hole might tell the story.

The small Quebrada Arenas anticline is near Vega Baja, about 10 miles west of San Juan. It lies on a concession covering the northwest part of the island held by Allas Tair Frazer Co., owned by British and Canadian interests.

A concession over most of the northeast coastal strip, including San Juan, is held by Cataract Mining Corp.

Contractors Busy

in Venezuela, but big four are still using own rigs.

CONTRACTORS have virtually taken over exploration and development drilling operations in Venezuela except on the preserves of the four biggest producers.

Creole, Shell, Mene Grande, and Socony Mobil still are investing heavily in their own crews and rigs. But most other operators, including all of the newcomers to Lake Maracaibo, are depending on drilling contractors for their work.

Here is the rundown:

	Rigs		Service Units	
	Company	Contractor	Company	Contractor
Atlantic	2	2	2	..
Creole	11	1	9	..
Mene Grande	18	9	14	..
Mercedes	..	3	..	2
Pan Venezuelan	..	1	..	..
Paria Operations	..	1	..	..
Phillips	..	4	..	1
Richmond	..	2	..	..
San Jacinto	..	1	..	..
Shell	10	..	3	..
Shell (Colon)	1	..	1	..
Signal	..	2	..	..
Sinclair	..	4	5	..
Socony	9	3	2	2
Sun	..	2	..	..
Superior	..	2	..	..
Texas	..	4	..	3
Total	51	41	36	8

BP EMPLOYE helps load ship in Middle East where . . .

Aden Is Becoming World's Top Fuel Stop

A SERVICE-STATION operator in El Paso or other inland areas might wince at the gallonage figures for the Aden bunkering station operated by British Petroleum Co., Ltd.

BP can pump bunker oil aboard visiting vessels at better than 5,000 bbl. per hour—or more than 210,000 gal.—through 14 offshore loading lines radiating from a tank farm on shore to eight oiling berths. This capacity is needed to handle the 300 ships which take on fuel at the station monthly.

The Aden facilities are big even for BP. They are the largest of the company's 180 bunkering stations. Aden itself is one of the world's best corners for bunkering trade. The port, on the southwest tip of the Arabian Peninsula, is expected to take away the lead from New York Harbor this year as the world's busiest fueling center.

Shell Disappointed in Dutch New Guinea

EXPLORATION gloom on the Australian side of New Guinea is crossing over to the Netherlands half of the island.

Royal Dutch-Shell says it will pull out of Netherlands New Guinea Petroleum Co. if no important discoveries are made within the next few years. It is 40% owner of the company which holds rights on nearly 62 million acres in Dutch New Guinea. Standard-Vacuum Oil Co. also owns 40%. Caltex has 20%.

Shell's dissatisfaction with the project stems from poor prospecting results and declining production. More than $110 million was spent to find and develop three small fields, Klamono, Wasian, and Mogoi. Their combined output hit a peak of 13,500 bbl. daily 4 years ago.

Production since then has slipped steadily. It fell to a low of 3,000 bbl. daily 3 months ago, picking up to about 3,700 bbl. daily the following month.

Papua work slows . . . Partners in Papua, the Australian side of the island, have stopped work on two wells. This probably means that exploration is drawing to a close unless other partners sign up soon.

Both British Petroleum Co. and Stanvac gave notice earlier this year that they would not sink more money into Papua unless something very encouraging showed up. They hold their interest through two jointly owned companies, Australasian Petroleum Co. and Island Exploration Co. BP and Stanvac each has 45% interest. Australian interests hold remainder.

The Papuan venture has cost more than $67 million. More than 17 wells have been drilled. There have been several strong gas flows but no commercial oil. To overcome costs and save time in moving rigs from one inaccessible drilling site to another, helicopters are used to transport rigs and other equipment, supplies, and personnel.

———World briefs

Tennessee Gas Transmission Co. has acquired a 1,445,000-acre concession in West Central Ecuador, about 20 miles north of Guayaquil. The area is geologically known as the Daule basin. Tennessee del Ecuador, S.A., wholly owned TGT subsidiary, will be operator. Field operations are expected to start about June 1.

A 27,000 - sq. - mile concession in western Algeria has been awarded to Ste. Anonyme Francaise de Recherches et d'Exploitation de Petrole (Safrarep). Whether the company's partners in another concession near Hassi Messaoud would participate was not immediately decided. They are Sinclair Oil Corp., Newmont Mining, Lazard Freres et Cie., and a French mining investment firm.

Ganso Azul Cia. de Petroleo has started geophysical work on its Consuelo concession in Peru. The company, a major producer in Peru's Agua Caliente field, is controlled by Texas Gulf Producing Co.

A contract for a $24-million expansion of Lujan de Cuyo refinery has been formally signed by Argentina's state oil agency. M. W. Kellogg Co. will handle process design and construction. French firms will supply equipment. The project received government blessings several months ago (OGJ, Feb. 17, p. 84).

Part of a concession in the Gabon region of French Equatorial Africa may be farmed out to Royal Dutch-Shell on a 50-50 partnership basis. The deal is being negotiated in Paris between Shell and Ste. des Petroles d'Afrique Equatorial Francaise (SPAEF), which holds a 45,000-sq.-mile concession in Gabon. The joint exploration play would be conducted in the southern part of the block.

Portuguese officials are being sounded out on a proposal for a refinery in Mozambique. The plant would have an initial capacity of 4,000 bbl. daily, which could be stepped up to 10,000 bbl. later. It would be located near Lourenco Marques, the capital of Portuguese East Africa.

An 80% interest in a Dutch Guiana concession has been farmed out to Gulf States Land & Industries, Inc., an affiliate of Webb & Knapp, Inc. The deal was made with Colmar Surinan Oil Co., Ltd., which holds a 40-year license over 14 million onshore and offshore acres.

Fig. 1

How about using thin-wall pipe

when it satisfies job requirements?

BY ROBERT S. RYAN
Supervisory Engineer
Columbia Gas System Service Corp.

MORE AND MORE natural-gas companies are leaning toward the use of thinner-wall pipe because there is considerable material savings possible, as shown in Table 1.

The minimum wall thicknesses described in ASA B31.1.8 have been adopted, but few companies have actually used the minimum wall-thickness pipe because it was felt that such pipe was not adequate to satisfy all the service requirements. There was also a question as to whether the savings in material cost would be offset by increased construction costs.

Recent experience indicates that thin-wall pipe can be used in construction without difficulty, and that there is no additional construction cost with thin-wall pipe in comparison with conventional-wall pipe. There is a greater tendency toward out-of-roundness in thin-wall pipe as the diameter increases, this tendency for out-of-roundness also increases.

The construction characteristics, such as bending, handling, and welding properties of thin-wall pipe, as opposed to conventional-wall pipe, are different to the extent that the design engineer should be aware of them.

Definition

The term "thin-wall pipe," as used in this article, is defined as thinner than conventional or standard-wall pipe, as shown in Table 2.

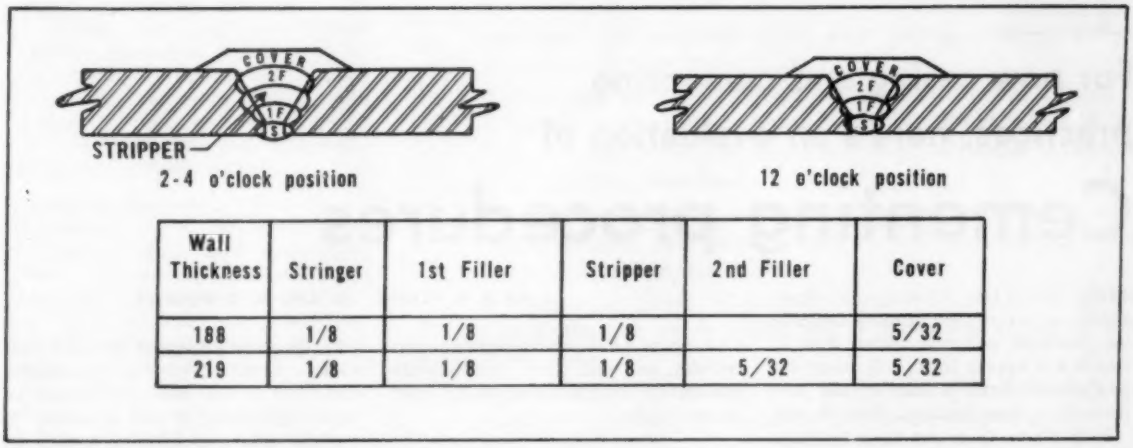
There is no "trade-mark" wall thickness that describes thin-wall other than the least nominal wall thickness, because thin-wall pipe in one part of the country may be different than in another location as a result of standard use. The thin-wall pipe shown in Table 2 is primarily applicable to distribution mains.

In the past, various diameters of pipe were purchased customarily on the basis of a conventional or standard-wall thickness. The more recent trend has been toward designing the wall thickness in accordance with service requirements rather than selecting the standard-wall out of habit. Another contributing factor in the increased use of thin-wall pipe has been the use of sound corrosion-mitigation practices, such as protective coatings, rectifiers, and sacrificial anodes.

Handling

Thin-wall pipe requires more care in handling than conventional-wall pipe in order to minimize the out-of-round condition at the ends and to prevent denting the wall. Any rough handling will easily produce a lip on the beveled end which makes it difficult to prepare for welding.

This condition can frequently result from dropping a length of pipe on one end during unloading or other



Wall Thickness	Stringer	1st Filler	Stripper	2nd Filler	Cover
188	1/8	1/8	1/8		5/32
219	1/8	1/8	1/8	5/32	5/32

WELDING PROCEDURE, horizontal fixed position, with thin-wall type. Fig. 2.

handling operations. The lineup clamp can usually correct for the out-of-round condition except for extreme conditions but will not correct for the lip on the end.

In many cases, thin-wall pipe is mill-coated, which requires additional care in handling in order to avoid damage to the protective coating. Normally, special precautions necessary for handling mill-coated pipe will be sufficient for handling thin-wall pipe. The 4 by 0.188-in. pipe, shown in Fig. 1, indicates the amount of sag that occurs when handling.

Bending

The bending characteristics are difficult to predict and cannot be freely generalized about. In most cases, the thin-wall pipe can be bent up to about 5° without any trouble. However, in some unpredictable cases, the pipe will buckle or crush after about 2° bend. In any event, this phenomenon is not unique to thin-wall pipe, as any person who has bent "high-chemistry" pipe will corroborate, and should not cause the operator any unusual hardship.

TABLE 1—COMPARISON OF COST FOR THIN-WALL AND CONVENTIONAL-WALL PIPE

Nominal size (in.)	Wall thickness (in.)	Weight per mile (tons)	Cost per ton ($)	Cost per mile ($)	Savings per mile ($)
4	0.250	30.0	181.20	5,436.00	.....
4	0.219	26.4	184.00	4,857.00	579.00
4	0.188	22.8	190.60	4,345.00	1,091.00
6	0.250	44.9	181.79	8,162.00	.....
6	0.219	39.5	185.62	7,331.00	831.00
6	0.188	34.0	190.16	6,465.00	1,697.00
8	0.250	59.0	178.01	10,502.00	.....
8	0.219	51.8	182.13	9,434.00	1,068.00
8	0.188	44.6	186.50	8,317.00	2,185.00
10	0.279	82.4	181.03	14,916.00	.....
10	0.250	74.0	182.74	13,522.00	1,394.00
10	0.219	64.9	186.50	12,103.00	2,813.00

Welding

Thin-wall pipe is readily weldable with the oxyacetylene welding process. This process is not considered practical in nominal pipe sizes larger than 4 in., so any further reference to welding will be the manual arc-welding process.

The welding of thin-wall pipe requires better fitup and the root opening is more critical. When welders are not acquainted with the required welding technique, they have some difficulty. For example, there is a tendency toward excessive burn-through in the stringer bead because of too much heat with an electrode that is too large. However, with a little practice, a qualified welder can learn the technique.

Procedure tests have been conducted to develop a welding procedure, as shown in Fig. 2, and it was found that satisfactory welds could be made in joining thin-wall pipe. The only difference in the welding technique between thin-wall pipe and conventional-wall pipe is the size of electrode and the amount of heat. It was also found that high-low and the root opening are more critical than for conventional-wall pipe.

TABLE 2—WALL THICKNESS OF THIN-WALL PIPE

(Nominal pipe size, inches)

O.d.	Conventional-wall	Thin-wall	Least wall ASA B31.1.8-1955*
4	0.239	0.188	0.125
6	0.280	0.188	0.156
8	0.277	0.188	0.172
10	0.279	0.219	0.188

*Table No. 841.141.

In the development of the welding procedure, it was found that there is a considerable difference in welding 0.219-in. wall and 0.188-in. wall pipe because there is a greater tendency to produce "windows" in the stringer bead as a result of burn-through.

There has been some little work done on thinner-wall pipe (less than 0.188-in.) and as the wall thickness decreases, there is a greater tendency to have areas of burn-through and lack of penetration.

About the author . . .

Robert S. Ryan, supervisory engineer for Columbia Gas System Service Corp., Columbus, Ohio, was process engineer and maintenance foreman with International Harvester Co. from June 1947 to November 1952. The next 3 years he was principal welding engineer, Batelle Memorial Institute, which he left in November 1955 to join Columbia, first as senior piping-design and welding engineer and then supervisory engineer. He is chairman of AGA-PAR Project NG-11 and NG-22, branch connections and secondary stress.

For new casing and cementing practices, here's an evaluation of

Cementing procedures

BY E. H. CLARKE, JR. AND A. S. MURRAY

THIS IS THE FIRST of three articles in a series on primary cementing problems and procedures. Part 2, which will appear later, will cover the analysis of field problems, and will present a case history. Part 3 will recommend casing-running procedures, and will cover shale disintegration as it affects cementing operations.

E. H. Clarke, Jr., is with Baker Oil Tools, Inc., Los Angeles, and A. S. Murray is with Imperial Oil, Ltd., Calgary, Alta.

Paper presented at API Production Division meeting, Los Angeles, 1958 under original title, "A Study of Primary Cementing."

The problem . . . During 1955, Imperial Oil, Ltd., had trouble in running longer-than-usual strings of casing in the development of Joffre field, Canada. Imperial's normal practice was to run 5,000 ft. of 7-in. production casing in a 9-in. hole. To protect an upper gas sand, it was necessary to run the cement to 2,000 ft. behind the pipe.

Tight hole and lost circulation occurred while running and cementing casing. A long swabbing period was

Table 1—Sample of

GENERAL INFORMATION		PREPARING FOR THE JOB								RUNNING CASING		
WELL NAME & NO.	CONTRACT RIG NO.	PROD. OPEN HOLE SIZE	PROD. STRING SIZE	NO. & MAKE OF CENTRALIZER	NO. & MAKE OF SCRATCHERS	FILLUP OR FLOAT	MUD PROPERTIES			JOINT DROPPING TIMES (AVE)		AVERAGE RUNNING RATE FT/HR
							TYPE	WT. IN LBS/GAL	MARSH IN SEC	SEC	AVE. JT. LENGTH	
#1	A	7 7/8	5 1/2	3-J	25-J	FLOAT	GYP	10.4	125	16	33	935
#2	B	9	7	3-K	24-K	FLOAT	GYP	10	65	29	33	810
#3	C	7 7/8	5 1/2	6-L	40-L	FLOAT	GYP	10.9	78	12	33	1,145
#4	D	8 5/8	5 1/2	6-K	33-J	FLOAT	OIL EMUL.	10.9	84	12	33	940
#5	E	9	7	3-L	25-K	FLOAT	GYP	10.3	65	15	33	975

J,K,L - DENOTES MANUFACTURER

Table 2—Sample of

BASIC DATA				COMPLETION FACTORS						
				ACID TREATMENT		SAND FRACTURING			SQUEEZING	
WELL NAME & NUMBER	DRILLED DEPTH	CASING DEPTH	PRODUCTIVE INTERVAL	MUD CLEAN-OUT - GAL	HCL GAL	LBS. SAND	BBLS. OIL	FINAL PRESS	SACKS	PRESS
#1	4,200	4,200	4156-73 (CH)	0	500	0	0	0	0	0
#2	3,885	3,885	3750-60 (HC)	0	500	0	0	0	0	0
#3	4,950	4,950	4278-83 (HC)	250	500	0	0	0	(ABANDON) 50	2,300
			4262-67 (C)	250	500	0	0	0	0	0
#4	5,517	5,517	5456-62, 32-37, 18-26, 05-13 (C)	250	0	19,000	200	4,000	0	0
#5	4,690	4,690	4642-52 (HC)	0	500	0	0	0	0	0

■ NOT RELEASED

required to remove mud lost to the formation. which had a subnormal pressure. Variations in the scratcher and centralizer programs were not successful in overcoming these conditions, so a study of casing-dropping rate, mud practice, and cement-displacement rate was started.

Casing-dropping rate . . . Data showed that Range 2, 7-in. casing was being lowered as rapidly as 5 seconds per joint. Calculations[1] indicated that dropping casing equipped with floating equipment at this rate could have caused momentary pressure increases as high as 2,300 psi. over the normal hydrostatic pressure, (the equivalent of boosting the mud weight from 10 lb. per gal. to 18 lb.). This increase, acting on a formation having subnormal pressure and an average permeability of 350 md., caused a large volume of mud to be squeezed into the formation. Repeated and rapid changes in well-bore pressure caused the shales to slough. The resultant loading of the hole in turn induced higher circulation pressure which caused loss of circulation[2].

AN INVESTIGATION has been carried out to evaluate recommended procedures for new casing and cementing practices. Results show:

- **Wells can be cemented with good assurance of success if current information is carefully studied, field tests are run to establish technique, and this proven technique is used to define field procedure.**
- **Primary cementing data are necessary to evaluate well performance and may be used to augment reservoir and geological information.**
- **When a problem well is encountered it is possible to follow a method of study which will disclose the cause of the trouble.**
- **Prior to cementing each well, a procedure should be set up which can affect the success of a primary cement job.**

Cementing-Data Summary

CLEANING HOLE		CEMENT JOB			REPORTED BY
HRS. CLEANING HOLE	STROKE LENGTH-FEET	CEMENT DISPLACED BY	STROKE LENGTH WHILE CEMENTING IN FT.	% CEMENT OUT OF PIPE WHEN RECIP. STOPPED	IMPERIAL SUPER-VISOR
1	30	RIG PUMP	30	73%	S
2	15	CEM TRUCK	0	0%	T
1	30	CEM TRUCK	30	100%	U
1 1/4	30	RIG PUMP	30	100%	V
1	30	RIG PUMP	0	0%	W

Well History and Production

PRODUCTION HISTORY			
MONTHLY GAS/OIL RATIO	MONTHLY WATER CUT IN %	MONTHLY OIL PRODUCTION	CUMULA-TIVE WATER CUT %
350 800	30 55 18		33%
NONE	100% SUSPENDED	NONE	100%
700 ABANDON 700 700	17% 60% 0 2	ABANDON	52% 1%
300 1000 700 650	0 0		0%
730	3 8 0 35 0		5%

Mud practice . . . The drilling-fluid program in Joffre often created unstable hole conditions prior to running casing. It had not been possible to log or test in this field when mud viscosity was lower than approximately 120 seconds (Marsh funnel). When drilling was suspended for these operations, mud viscosity was raised from approximately 50 to 120 seconds. After logging and testing viscosity was watered back to 50 seconds. These severe changes in mud properties often resulted in tight and bridged hole.

Displacement rate . . . Several papers on cementing practice have pointed out the advantage of cement displacement under turbulent-flow conditions. In Joffre it was noted that in about 5% of the wells, displacement was made using the service-company cement-truck pump (low rate displacement). This could have contributed to channeling and nonscouring of wall cake.

These factors were corrected . . . By using bottom-fill casing fittings, reducing casing-dropping rate, discontinuing the practice of watering back to lower mud viscosity, and increasing cement-displacement rate by using the rig pump. These actions eliminated the lost-circulation problem and mud production on initial completion. Pipeline oil was produced with minimum swabbing time. There were no further primary cementing failures in Joffre field.

Additional Research

Success in using a few basic principles in this area led to a survey of cementing practice in all of Imperial's western Canadian operations. The

analysis showed that not enough information was being kept to evaluate primary cementing practice and there was a difference of opinion as to what constituted a casing cement failure. Frequency of failure was estimated to be between 8 and 15%. Cost of repair work and lost production from 8% of the wells can mean a lot of money, so an investigation of cementing procedures was started.

Casing procedure recommended . . . Data sheets like that shown in Table 1 were used on all drilling jobs. Each data sheet was set up so that one man could record the information without leaving his routine duties. Recommended procedure for running and cementing casing was outlined on another sheet and distributed to all drilling personnel. This procedure was not adopted as a company standard at this time, since it was not yet field proven. Also, other methods in current use provided good comparative information.

It was felt that rig crews should understand the importance of accuracy, detail, and the reason for the project. Besides, it was imperative that members of the study group, who were responsible for evaluating the data, have a thorough knowledge of field procedure and problems. Personnel from this group were on hand at casing-cementing jobs where possible to explain the data sheets and help in filling them out.

Data organized . . . Files were set up to organize information on contractor equipment, penetration rate, mud-circulation pressure, and casing-cementing procedure. A summary was kept listing each well by field and well number showing the major factors from each of the cementing data sheets to make evaluation easier (Table 1). A summary of production history was also made on each well (Table 2).

Casing procedure adopted . . . A progress check was made at the end of 5 months when data from 130 wells were available. Ninety-three had been cased-through and perforated; 33 were completed open hole; 13 were abandoned; and 1 was completed as a salt-water-disposal well. Open-hole completions were not evaluated since production is not obtained from the cemented area. Abandonments and the salt-water-disposal well were also set aside. Cementing data and production histories from the 93 cased-through and perforated completions were used to determine whether or not a primary cement job was under suspicion as a failure.

TABLE 3—SUMMARY OF WELLS BY CEMENTING PRACTICE

Category	Class A	Class B	Class C	Class D
1—Poor cementing practices Total: 10 jobs	5	2	2	1
2—Fair cementing practices Total: 15 jobs	1	0	0	14
3—Good cementing practices Total: 130 jobs	0	2	1	127
4—No cementing data available Total: 17 jobs	2	0	0	15

This study showed that cement-plug displacement under turbulent-flow conditions was desirable; that reciprocation of casing until the plug bumped was necessary; and that there was a need of a set procedure for running and cementing casing. Results were discussed with all operating personnel. A standard procedure for running and cementing casing in Imperial's western regional operations was adopted (Appendix 1, Part 3).

Wells Classified

A final summary was made at the end of a year when data from 256 wells were available. One hundred and eighty-five of these were cased-through and perforated completions. The rest were open-hole completions, abandoned, or salt-water disposal wells. After up-to-date production summaries had been made on each cased-through completion, reservoir engineers and geologists were consulted to provide additional background. Daily operating histories, acidizing records, and detailed core analyses were also studied where well performance was questionable.

By production performance . . . The production history of each well was then classified in the following manner:

1. Class A included wells where zonal communication existed as a result of primary cementing failures.
2. Class B included wells on which definite communication existed between zones. Data, however, did not indicate whether communication resulted from primary cementing failure or completion practice.
3. Class C included scattered field wells where incomplete reservoir information failed to explain why productivity differed from expected values.
4. Class D included wells which had normal initial and long-term production histories.

By cementing practice . . . After classifying all wells according to production performance, a new breakdown based on cementing practice was made as follows:

- **Category 1, Poor Cementing Practice.** Wells on which there were no casing reciprocation while any cement was outside the pipe. Cement was displaced with the service-company pump at a low rate.
- **Category 2, Fair Cementing Practice.** Wells in which reciprocation was stopped before any of the cement was out of the pipe but where cement was displaced with the rig pump. Calculations based on average cement slurry, pumping rate, and annular clearance, showed that the use of the rig pump put the slurry into transition flow or possible turbulent flow, thereby giving a much better chance of success than Category 1, even though the pipe was not reciprocated. Wells where reciprocation was carried on until at least 10 to 50% of cement was out of the pipe were also included even though cement was displaced under laminar flow.
- **Category 3, Good Cementing Practice.** Wells in which casing was reciprocated until the plug bumped, or until at least half of the cement was out of the casing with cement displaced by using either the cement-truck pump or rig pump.
- **Category 4.** This refers to wells on which the cementing data were too incomplete for analysis.

Results

Table 3 combines the well histories and cementing practice of 185 wells which formed the basis of analysis for this project. Production histories on 13 of these wells were too brief for competent analysis.

Ten wells are included in Category 1—Poor Cementing Practice. Fifty per cent of these exhibited zonal communication due to primary-cementing failure. Twenty per cent exhibited zonal communication attributed to either completion practice or primary-cementing procedure. Twenty per cent of the wells did not yield as expected (based on all available geological and reservoir information). Only 1 well in 10 was normal for the area in which it was drilled. It was fortunate that this well was drilled in a section of the field where oil was the only reservoir fluid.

Fifteen wells are included in Category 2—Fair Cementing Practice. Only one well or 7% of the total was classified as a failure. It was noted that where there was even a slight amount of reciprocation with cement outside the pipe or if the rig pump was used to maintain upper laminar or transitional flow, an improvement in the well success rate resulted.

There were 130 wells in Category 3—Good Cementing Practice. There were no wells in which failure could be attributed directly to the primary cement job. Zonal communication was indicated from the performance of two wells. It was not known whether this resulted from the primary cement job, or from completion practice because of insufficient information. One well in Class C of this category did not yield as expected and data were incomplete for further study. Ninety-eight per cent of the total wells in this category were normal.

Seventeen wells, two of which were suspected failures, were included in Category 4—No Cementing Data Available.

Summary . . . When poor cementing practice was followed, 90% of the wells were problem wells. When fair cementing procedure was adopted, problem wells were reduced to 7%. When good cementing practice was adopted only 2% were problem wells, and these were probably not associated with the primary cement job.

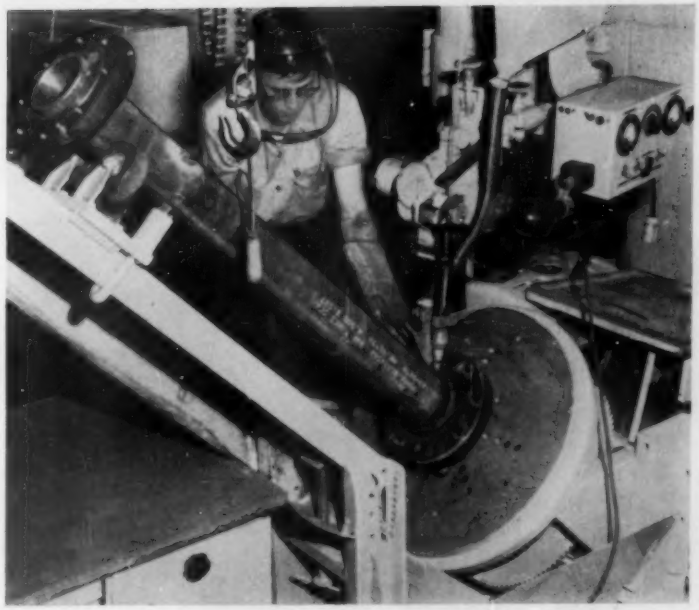
It was noted that virtually all of the well problems occurred during the first period of the survey before the cementing procedure was adopted. After the results of the preliminary survey had been released, there was only 1 well out of 92 classified as a probable failure. Good practice had not been followed on that well.

The primary cementing procedure (Appendix 1, Part 3) which had been set up, appeared satisfactory and changes were not recommended. Routine casing-cementing data sheets were reduced to include only the most important facts and were made a part of Imperial's well-history files. Primary cementing information from these data sheets can be used to augment reservoir, completion, and geological knowledge when evaluating well performance.

References

1. Clark, E. H., Jr., "Bottom-Hole-Pressure Surges While Running Pipe," ASME Paper No. 54, Pet. 22—also—Petroleum Engineer, January 1955.

2. Clark, E. H., Jr., "A Graphic View of Pressure Surges and Lost Circulation," API Drilling and Production Practice, 1956 Edition, p. 424.

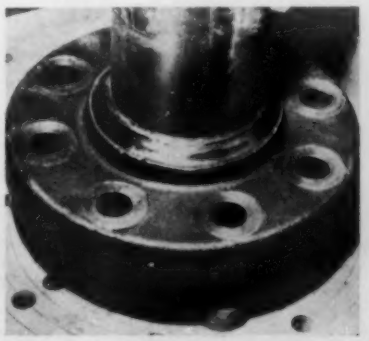


Flange gets final pass as Northern Natural adopts

New welding process

TO SPEED PRODUCTION of gas-flowmeter tubes, Northern Natural Gas Co., Omaha, Neb., recently changed from covered-electrode welding to Linde's Unionmelt welding process. The change paid off—with a 52% saving in production time, plus more uniform weld quality in the bargain.

These mild-steel tubes, used at town borders to register natural-gas flow, are made up of three pipe sections—2, 4, and 6-ft. long, respectively. Flanges are Unionmelt-welded to the ends of all three pipe sections. After finishing, the sections are bolted together to form the completed tube.



THIS low-porosity weld was made in three passes with welding machine. A 52% cut in production time was partly due to elimination of post-weld finishing previously required.

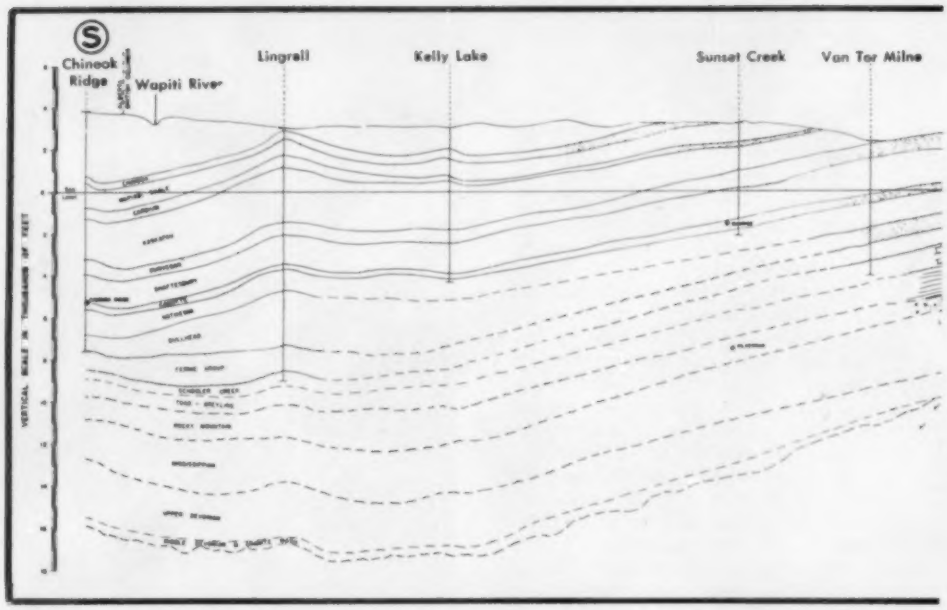
When the flowmeter tube is connected to the natural-gas line, a flow-registering device indicates the rate of gas flow through the line. This device is attached to the tube between an outlet on the center section and another outlet on the 6-ft. section or downstream side of the tube. The pressure differential between these two points registers the flow rate.

All three sections of the tube have approximately a 4.1-in. i.d. and 0.275-in. wall thickness. A drop-forged flange is tack-welded in place on the ends of each piece. After the sections are positioned, a welding machine with a DSH head is used to make three passes on the exterior and two passes on the interior of each flange.

These high-quality welds are made at a speed of 16 in. per minute, using 40 volts and 300 amp., DCSP, with Unionmelt No. 50 welding composition. This process produces low-porosity, X-ray quality welds that require no post-weld finishing.

EXPLORATION

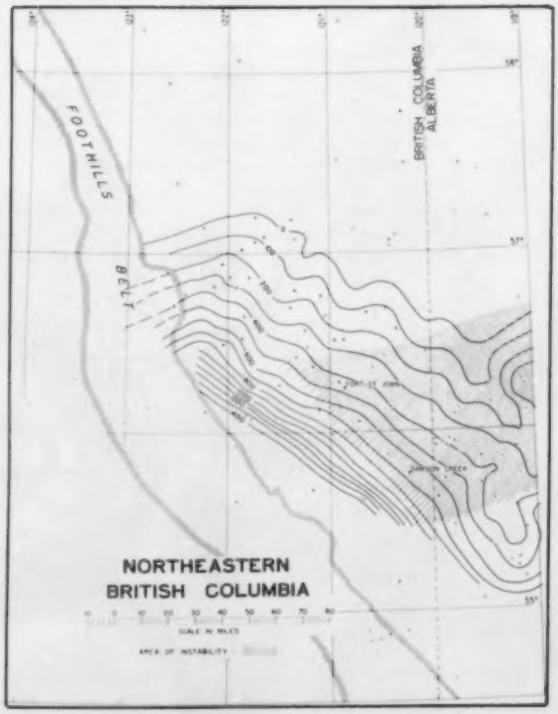
GIANT OF THE FUTURE—
PART 2



This diagrammatic north-south cross-section shows . . .

Northeastern British Columbia

BLUESKY-GETHING-CADOMIN formations are shown on this isopach map, using 100-ft. contours. Fig. 9.



JURASSIC formation is shown on this isopach map, using 100-ft. contour intervals. Fig. 10.

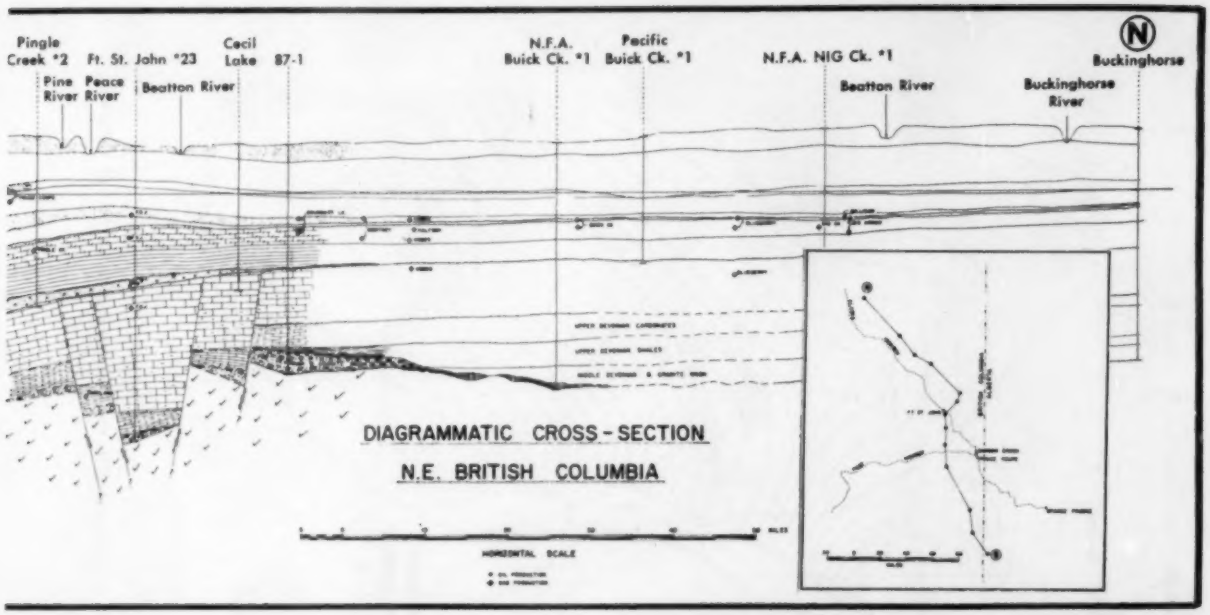


FIG. 8

offers lucrative oil hunting

BY G. L. GRAY

THE DEVONIAN, Mississippian, Triassic, Jurassic, Cretaceous, and Quaternary systems are represented in both surface and subsurface occurrences. Beds of doubtful Cambrian age have been tentatively identified in subsurface and surface, and the Ordovician has been reported in surface outcrop only. Surface outcrops of ascertained Silurian age are known, but this system has not been recognized in drilling.

It is doubtful if rocks of the so-called Permo-Penn formation are time equivalents of both of these systems. Recent evidence indicates this formation is equivalent to the Rocky Mountain formation of lower Pennsylvanian age.

Small isolated deposits of Tertiary age exist, but this system is in the main absent, and is of no concern as a commercial prospect. Pleistocene and post-Pleistocene beds in the form of glacial till and river gravels cover much of the area of the foothills and interior plains.

Fig. 3 and 4 (see Part 1) are synthetic columnar sections at Dawson Creek in the south and Fort Nelson in the north. These indicate representative thicknesses and lithologies of the formations in each area.

Most formations are thicker towards the center of the depositional basin toward the south and west; they thin and in some cases wedge out to the north and east. This generalization is modified by local structure and the thickening accentuated basinward from the hinge line running through the Fort St. John area. The reverse is true in the case of Devonian sediments which thicken to the north and east.

A brief discussion of each system, its lithology, distribution, and its reservoir possibilities follows.

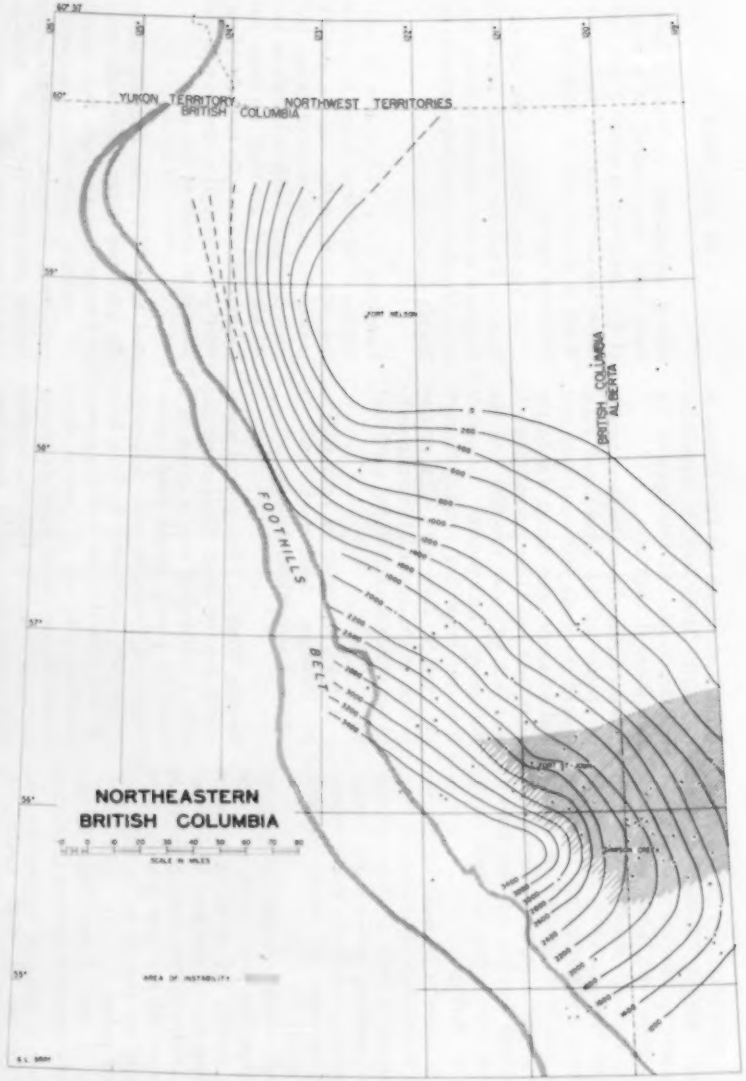
Granite Wash . . . This general name, which has no time significance but only a lithological one, is given to a series of poorly sorted sands, sometimes conglomeratic and frequently feldspathic, considered to have been derived from the erosion of the granite basement. The age of Granite Wash is variable and ranges from pre-Middle to Upper Devonian. It is interfingered with marine sediments of Middle and Upper Devonian age, a situation which apparently arose from its deposition during intermittent periods of basement uplift and erosion. As a result of the conditions in which it was laid down, the lateral extent of the Granite Wash is limited and its variations in thickness rapid.

Oil has been found in the Granite Wash in a number of widely separated locations in northwestern Alberta, but as yet no shows have been reported in British Columbia.

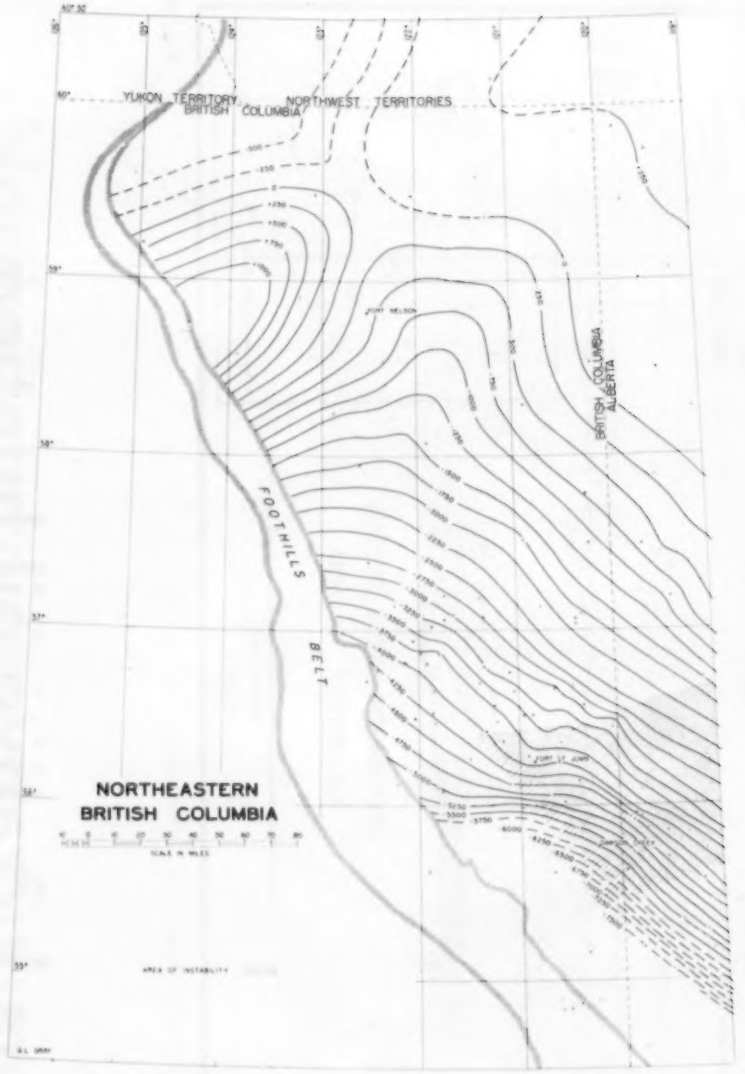
Cambrian . . . This system is considered to have been found in only a few scattered wells, and its identity is doubtful as no proof of its age has been published. Little is known of the thickness and lithology of these so-called Cambrian beds and, therefore, their potentiality as a reservoir is not possible to assess at this time.

Red beds . . . These beds lie below the Elk Point group, the lowest rocks of known Devonian age, and consist of reddish anhydrites, dolomitic anhydrites, and marls. Their age is not known and may vary with locality. Due to poor control their distribution is not accurately known, but they occur north of approximately 56° 30′ N.

Author is geological engineer with the consulting firm of Hunt, Ratcliffe, & Gray, Calgary. Part 1 of this article appeared in the Journal's annual Canadian issue, August 18, 1958, p. 128.

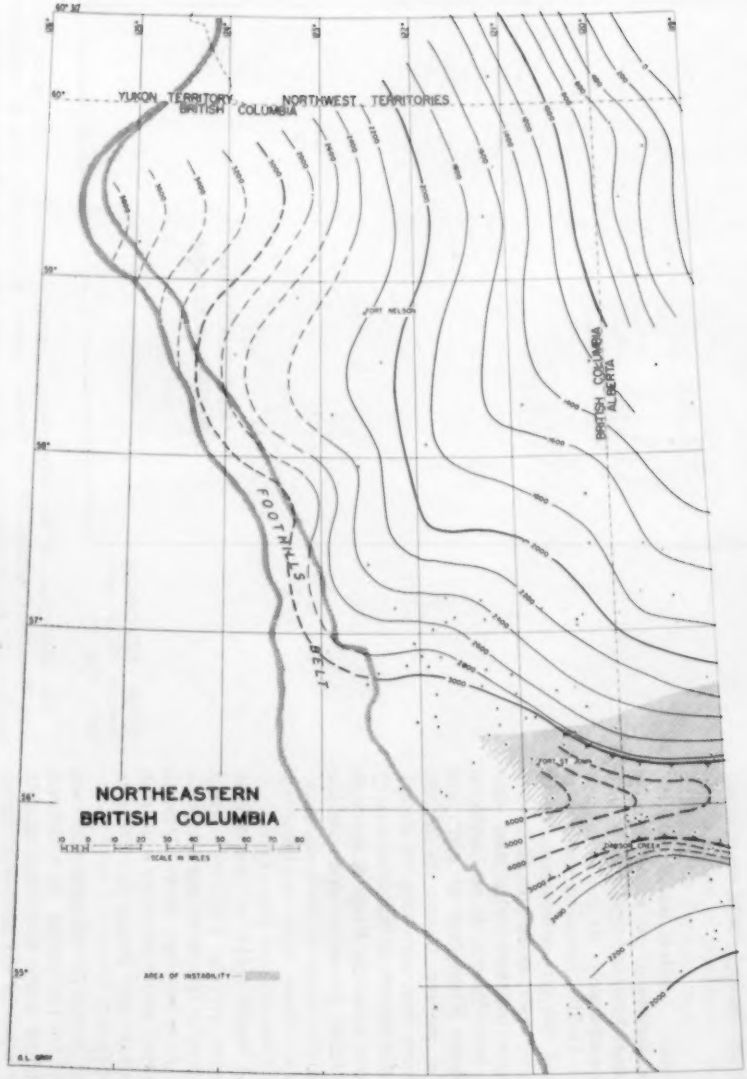


TRIASSIC in northeastern British Columbia is shown on this thickness map. Fig. 11.



STRUCTURE on top of the Paleozoic in the interior plains of British Columbia. Fig. 12.

THICKNESS of the Permo-Penn section. Fig. 13.



THICKNESS of the Mississippian section. Fig. 14.

in British Columbia. There has been no indication to date of any potentiality of the red beds as reservoir rocks.

Devonian . . . Only the Middle and Upper Devonian are known in the area and these are conveniently considered separately.

The Middle Devonian exists over most of the area concerned. In the south, however, in the area of Dawson Creek, a basement ridge runs eastward into Alberta. It is known as the Peace River high or arch, and was a positive feature in Middle Devonian time, preventing the deposition of sediments in that area.

North from the Peace River high, the Middle Devonian strata thicken toward the center of the basin of deposition. There their thickness exceeds 1,800 ft. (See Fig. 16).

The basal rocks of the Middle Devonian are the Elk Point group, consisting of anhydrites and dolomites. This group becomes more calcareous northward where its facies equivalent is called the Presqu'ile dolomite. (See Fig. 4.).

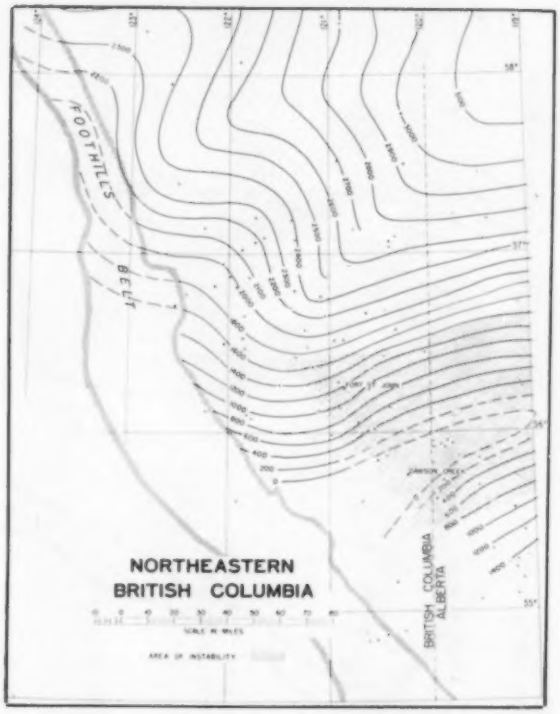
The Presqu'ile dolomite has been shown to be porous in California Standard's Steen River and Shekilie River wells in the northwest corner of Alberta and it has also given considerable gas shows in the same area. This porosity probably extends into northeastern British Columbia.

Above the Elk Point group occurs the Slave Point limestone. This reaches a maximum thickness of 400 ft. in the center of the Middle Devonian basin.

The continued existence of the Peace River high in Upper Devonian times limited to the south the deposition of the sediments of that age. Before the end of Devonian times, however, the basement ridge became submerged, permitting the deposition of the Wabamum, the youngest Devonian formation, over the whole area.

The center of the Upper Devonian basin in the area lay to the north and east in the northwest corner of Alberta. The beds of this age, therefore, thicken northward and eastward and in the area under discussion reach a maximum thickness of 3,000 ft. in the region of 58° N. and the Alberta-British Columbia border (Fig. 15).

On the south of the area described and flanking the Peace River high on its north side, the stratigraphy of the Upper Devonian sediments is considered to conform more or less closely with that of the Green Shale basin of Central Alberta, although distance and insufficient well data make this correlation difficult. Northward the lithology changes.



UPPER DEVONIAN isopach, 100-ft. contours. Fig. 15.

The limestones of the Winterburn and Woodbend groups of the Green Shale basin facies shale out and are replaced by some 1,800 ft. of shales with occasional thin interbedded limestones. Although this interval has been as yet little drilled and has offered no encouragement, the change of facies from limestone to shale northward offers hope of favorable entrapment conditions.

The uppermost member of the Upper Devonian, the Wabamum group, covers the whole of the area in question, and although its top is disconformable, its thickness varies little from an average of about 1,200 ft. Its upper half is composed of limestones and dolomitic limestones and its lower part of somewhat silty equivalents.

Few wells have been drilled through this horizon and none have had any shows of oil or gas as far as is known.

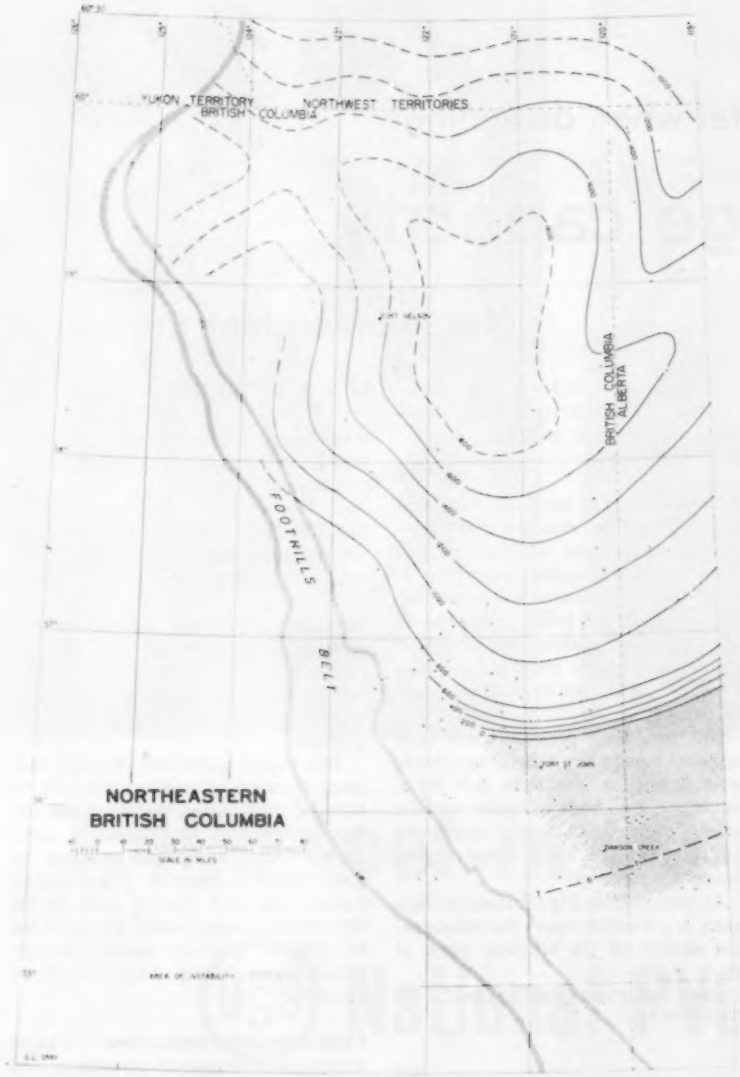
Mississippian . . . The Mississippian lies disconformably on the Devonian beds below, being separated from the latter by the thin Exshaw shale of controversial age. The basal Mississippian formation is the Banff, consisting of calcareous shales and limestones. This formation, which is truncated by erosion and is some 450 ft. thick in the extreme northeast corner of British Columbia, is known to be 1,400 ft. thick in the Fort St. John area. It has little attraction as a possible reservoir.

Above the Banff lies the Rundle group, principally of carbonates with some evaporites. This is truncated and absent in the extreme northeastern part of the area and some 2,300 ft. thick in the Fort St. John area.

In late Mississippian and early Pennsylvanian times considerable instability occurred; this resulted in the formation of local structure and subsequent erosional thinning of the Mississippian Rundle formation over these structures. Little is yet known about these structures, but a better understanding of them which will come with more drilling may well enhance the attractiveness of both the Rundle and overlying Rocky Mountain formation as reservoir rocks.

The instability referred to above caused a complex downwarping or downfaulting in late Mississippian time of an area south of Fort St. John and extending east into Alberta. This allowed the protection from erosion of the Stoddart formation, which lies above the Rundle and is a very heterogeneous formation, reflecting the conditions of its depositional environment. The Stoddart is limited in its present distribution and of highly variable thickness, the maximum known being 2,160 ft. in Pacific 23 Fort St. John. Fig. 14 is a regional isopach of the Mississippian rocks.

Pennsylvanian . . . The actual age of this formation (commonly known as Permo-Penn) is in doubt, and its common name is derived from its stratigraphic position.



MIDDLE DEVONIAN isopach, using 200-ft. contours. Fig. 16.

The system consists of sandy dolomites and dolomitic sandstones with chert throughout. Local structures form reservoirs in the Permo-Penn as at Fort St. John and Kobes.

Erosion has thinned and truncated the system to the north and east, and a belt some 20 to 30 miles wide runs northward along the eastern edge of the mountain front thickening into the Liard basin located in the extreme northwest portion of the map area; here, more than 5,000 ft. of equivalent sediments has been mapped within the disturbed zone. Fig. 13 shows a general isopach of these deposits east of the disturbed belt.

Triassic . . . This system overlies unconformably the Permo-Penn or Mississippian, and is represented in the subsurface by two formations: the lower or Toad-Grayling and upper or Schooler Creek.

The former consists of shales and siltstones and attains a maximum known thickness in the area of 1,600 ft. In the region under consideration, its lithology seems to preclude any reservoir potential; however gas shows have been encountered in a few wells.

The Schooler Creek thins from 1,800 ft. to zero at its truncated edge to the north and east (see Fig. 5, Part 1). Three lithological units comprise this formation: a calcareous sandstone at the base, the "C" and "D" reservoirs; the middle evaporite, the anhydrite zone; and an upper dolomite in which exist the "A" and "B" zones of porosity. This group furnishes a widespread reservoir throughout the area. Fig. 11 is a regional isopach of all Triassic rocks.

Jurassic . . . The rocks of this system overlie unconformably those of the Triassic or Mississippian, depending on the extent of pre-Jurassic erosion.

The basal Jurassic member is the Fernie group of black shale and calcareous shales. From a truncated edge this group thickens southwestward to a proved thickness of more than 500 ft.

Above the Fernie group lies the Nikanassin formation with the main body covering the Fort St. John-Halfway area, and thickening to the southwest. Fig. 10 is a general isopach of the Jurassic.

Cretaceous . . . This system consists of interbedded shales and sandstones, and although Cretaceous rocks cover the whole area (except for local erosion over structures in the foothills belt), the system becomes more argillaceous northward and eastward. (See Fig. 6, Part 1).

The sands which are numerous in the south of the area shale out northward; the younger, such as the Cardium, generally go out first (see Fig. 6).

The basal Cretaceous conglomerate, the Cadomin, has a somewhat ill-defined and sporadic distribution. This unit attains a maximum mapped thickness of some 250 ft. in the southwest of the area. Economically, the Cadomin is a good prospect and considerable reserves of gas have already been proved in this member.

The Gething sandtsone has a greater extent than the Cadomin which it overlies. This member shales out northward and eastward (see Fig. 6), and thickens westward and to the south. Sands within the Gething form many prolific reservoirs in such fields as Buick Creek and Boundary Lake. Fig. 9 is an isopach of the Bluesky, Gething, and Cadomin formations of the Bullhead group.

The Notikewin sandstone is somewhat more limited in extent than the Gething. This sandstone has not so far proved an attractive pay zone, only one small gas well, PRNG 5, having been completed in the sand.

The Cadotte sandstone, although a good reservoir in the Pouce Coupe area, shales out to the north where it becomes less significant as a reservoir rock.

Many targets . . . In brief, the area is underlain by a large thickness of sediments. Many of these have been proved as potential reservoir rocks; a number of others have been little tested by drilling and remain as oil and gas prospects worthy of further investigation. The existence of structures, truncation edges, and facies variations enhance its attractiveness.

Practical planning is vital when designing

Large storage capacity

for independent producers

BY H. C. SCHUTT AND A. R. MATTIOLI

A LARGE REFINERY, a natural-gas processing or a transportation company producing olefins from by-products of their normal operations and selling them on demand to several manufacturers of organic chemicals, may be termed independent producers. For such operators, appropriate olefin storage facilities should offer, at least, a reserve supply equivalent to the normal production during 4 stream days in order to permit convenient scheduling and coordination of maintenance activity by the producer as well as the consumer.

Insulated Tanks Aboveground

As a practical case, one may consider a plant producing ethylene at the rate of 600,000 lb. per day and storage capacity for 4 days' production would amount to 2,400,000 lb. This would require 12 tanks, each 12 ft. in diameter and 72 ft. straight length, assumed to be filled to 90% of their actual volume.

H. C. Schutt is a consulting engineer. A. R. Mattioli is with Stone & Webster Engineering Corp. The first part of this series appeared on August 4.

Insulation . . . The tanks are insulated with a suitable material for low-temperature service, such as bonded Fiberglas blocks, approximately 6 in. thick. A radiant-heat-reflecting, smooth, aluminum jacket is applied as outer covering, sealing the insulation against atmospheric moisture and also affording protection against mechanical damage.

This insulating provision will hold the heat transfer from the atmospheric environment to less than 6.0 B.t.u. per sq. ft. per hour of outer surface under average climatic conditions prevailing in the Gulf Coast region during the summer.

As indicated in Fig. 5, these storage tanks are located near the fractionation section of the ethylene plant at a minimum distance from the battery limit, conforming to underwriters' recommendations.[4]

Refrigeration . . . The pressure and temperature are held constant by autorefrigeration and the vapors evolved are withdrawn into the ethylene compression system of the production unit. When the ethylene unit is completely shut down, including the refrigeration system, the liquid is pumped through a heater into the pipeline.

The vapors generated through heat absorption are released to the flare or into the distribution system if the design pressure of the vessels is compatible with the pipeline pressure. In some cases, a separate Freon refrigeration unit and cooling coils in the top of the storage tanks are provided to prevent product losses through evaporation during long shutdown periods.

Costs—insulated tank system . . . Table 3 contains estimates of investment and operating costs for such storage facilities when installed and operated in conjunction with the production unit. When considering a depreciation rate of 10%, 5% interest on investment or unamortized capital, normal charges for operation, maintenance, taxes, insurance on plant and inventory, overhead, etc., it appears that such storage facilities will add approximately 0.13 cent per lb. to the ethylene production cost. Although the installation cost of the storage facilities may add from 15 to 20% to the total investment in the ethylene plant, the increase in production cost appears to be relatively small.

TABLE 3—INVESTMENT AND OPERATING COST OF ETHYLENE STORAGE IN ABOVEGROUND TANKS

Design basis:	
Ethylene plant capacity, 1,000 lb./stream day	600
1,000 lb./year	200,000
Storage capacity (4 days' production) lb.	2,400,000
Storage temperature, °F.	—40
Storage pressure, psig.	203
Design provisions:	
Number and size of tanks	12 — 12 x 72 ft.
Design temperature, °F.	—50
Design pressure, psig.	250
Tank material; ASTM classification	A300 Class 1
ASTM grade	A212 Firebox
Insulation thickness, inches	6
Investment cost:	
Tanks, piping, instruments, and insulation	$865,000
Refrigeration, equipment (self-contained)	28,000
Pumping and vaporizing equipment	22,000
Foundations, supports and miscellaneous	35,000
Engineering, field erection, contractor's fee	350,000
	$1,300,000
Annual operating cost:	
Depreciation (10% of investment)	$130,000
Interest, taxes, insurance	91,000
Utilities and supplies	3,000
Maintenance	19,500
Operating labor and overhead	13,500
	$257,000
Cost per pound of ethylene produced, cent	0.13

Subsurface Pipe or Pipe Sections

Several gas-utility companies[3] have installed in recent years natural-gas storage facilities in the form of 24-in.-diameter random length, seamless-steel pipe sections or bottles to create a reserve gas supply for daily or seasonal

1,400 feet in 90 minutes

USS National PVC Pipe

It took slightly less than 90 minutes for the Carter Oil Company to install this 1400-foot flow line of USS National Polyvinyl Chloride Pipe. A crew of four men, using normal-impact 3" pipe and a solvent cement, were able to do the job with remarkable ease.

This particular flow line services a well near Henderson, Kentucky, which pumps about 100 barrels of salt water for every 50 barrels of oil. National PVC Pipe can be depended upon to resist corrosive salt solutions in the line—a vital requirement in an operation such as this one. PVC Pipe is also immune to acids, alkalis, fungi, bacterial action and soils, plus a multitude of chemicals.

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For the full story of USS National PVC Pipe, send for Bulletin 24. Write to: National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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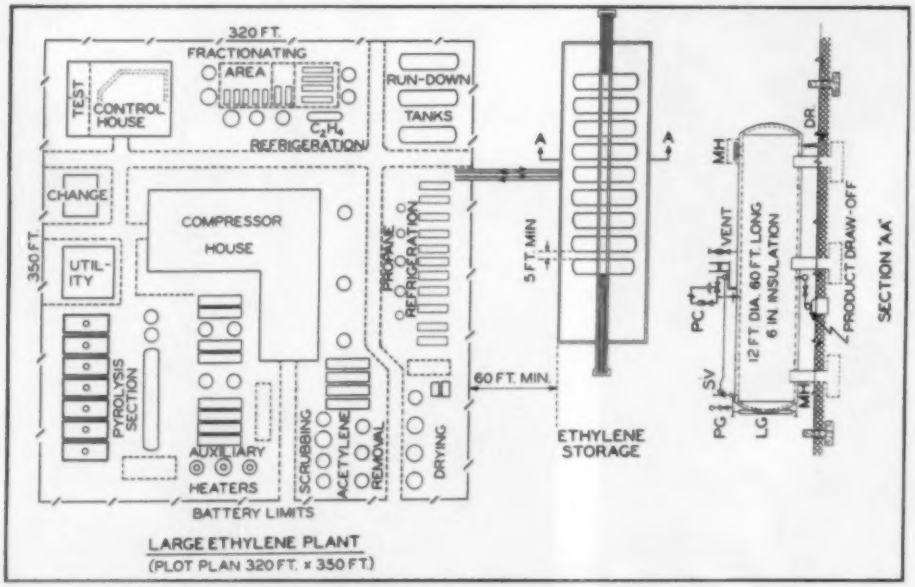


ETHYLENE STORAGE in cylindrical tanks. Fig. 5.

peak loads. These pipe sections or bottles are laid underground at a depth sufficient to be unaffected by daily or short-time temperature variations, but close enough to the surface to follow seasonal temperature changes and provide greater storage capacity during the winter months, at which time the gas reserve is most needed.

Pipe bottles . . . In some installations the bottles are manufactured of high-strength steel corresponding to API Specification N80 which has a minimum yield strength of 80,000 psi. at a working pressure of 2,240 psig. Since this material is not readily weldable, the ends of the pipe section are swaged down and tapped for 1½-in. IPS-threaded pipe connections.

Pipe-section batteries . . . Natural gas is also stored in batteries of pipe sections composed of random lengths of high-pressure transmission piping welded together and capped at the ends. These pipe sections are connected to each other and to a manifold in a similar manner as the pipe bottles described above. The pipe batteries are operated at pressures up to approximately 1,500 psig. as limited by the size and kind of pipe material used. Pressures in the neighborhood of 1,500 psig. are also considered the maximum which should be employed for the storage of ethylene, since it has a tendency to form polymers and higher pressures might throw the products off specification during the relatively long storage periods involved.

Assuming a distribution system delivering ethylene product at the rate of 600,000 lb. per day to several consumers located 70 miles from the ethylene production plant, the transmission line would have to be 8 in. in diameter when supplying the product at a minimum pressure of 250 psig. to the consumer.

Further assuming a storage pressure of 1,450 psia. (at which the density of ethylene is 22.3 lb. per cu. ft.) approximately 1,060 pipe sections or bottles (each 40 ft. long, 24 in. diameter) would be required to provide storage for 2,400,000 lb. of ethylene, equivalent to 4 days of the normal plant production.

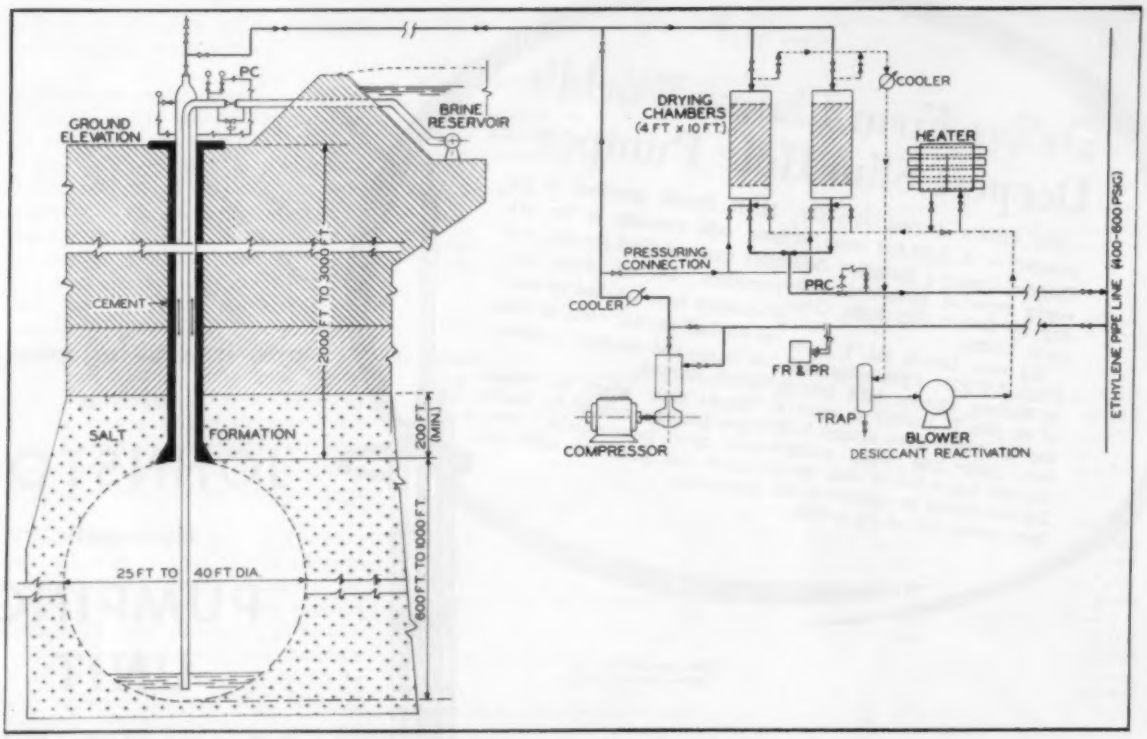
Pipeline storage . . . When the ethylene is distributed to chemical plants by pipelines which are usually laid 4 ft. below grade, the thought naturally occurs to use this product conduit simultaneously for storage purposes.[8] This can be done by maintaining an average pressure in the order of 1,425 psig. in the pipeline and rating it for an operating pressure of 1,450 psig.

The product reserve contained in a 70-mile-long transmission line made of 8-in. Schedule 40 pipe and having a volume of 128,400 cu. ft., would be in the order of 2,500,000 lb. which may readily be determined from the difference in the ethylene density at 1,440 psi. and 60° F. and at 325 psia. and 60° F. The cost of such storage provision would be the difference between the installation of an 8-in. Schedule 20 pipe and of an 8-in. Schedule 40 pipe, assuming that the cost of the right-of-way remains the same.

Costs—subsurface pipe systems . . . Principal item of operating cost would be the sacrifice in refrigeration value of the product stream and the higher pumping duty. The produce has to be continuously delivered into the transmission line at a pressure in the order of 1,440 psig., while with the storage and pipe sections or bottles, the normal product transfer into the pipeline will require only a pressure in the order of 375 psig., permitting vaporization at approximately 0° F. and use of the corresponding heat of vaporization as refrigeration in the ethylene plant. Table 4 gives an evaluation of the investment and operating costs for both methods of subsurface pipe storage in terms of cost per pound of ethylene delivered to the consumer.

Oversized pipeline vs. bottle "acreage" . . . It appears that the oversized pipeline offers advantages over the "acreage" of steel bottles for the assumed situation. It would also seem preferable from the standpoint of product uniformity and purity. The ethylene held in the high-pressure line is continuously displaced and replaced with new production while the material

"Natural gas is also stored in batteries of pipe sections composed of random lengths of high-pressure transmission piping welded together and capped at the ends."



ETHYLENE STORAGE in underground cavities. Fig. 6

stored in bottles is held at a relatively high storage pressure for a long time, 6 months or a year, depending on the shutdown frequency of the production unit. Although the temperature is low, around 60° F., some polymerization or dimerization of the ethylene can take place over an extended time and throw the product off specification.

The bottles could be so arranged as to give continuous displacement of the storage volume, but then no refrigeration can be recovered and the high-pressure transmission line would be decidedly more favorable from an investment and operating standpoint. It should also be considered that a large storage area adjacent to the processing units usually presents an impediment to future expansion of manufacturing facilities.

Dissolved Cavern in Salt Strata

The creation of such cavities requires an accurate knowledge of the geological formation, the extent of the salt strata in area and depth. The drilling procedure, the method of washing out a cavity of the required size as well as the problems involved, are described in several articles published in technical journals in recent years.[1 2 7]

The Natural Gasoline Association has prepared a tentative standard (August 1952)[5] for the construction of underground storage wells, which constitutes a guide for projecting and designing such installations.

Washed out cavity . . . Salt domes or strata in the Gulf Coast area are usually located at a depth of between 2,000 and 4,000 ft. and the cavity washed out is of oval shape. Fig. 6 illustrates the layout and operation of such a storage reservoir in conjunction with a pipeline distribution system. When the ethylene production exceeds the demand, the surplus product is compressed from line pressure up to the storage pressure which will depend on the depth of the cavity and the method of its operation.

The withdrawal from the well can be accomplished by brine displacement which will require a relatively large brine reservoir with a holding capacity considerably in excess of the volume of the cavity. The salt solution must always be saturated to avoid further washing out of salt and an increase in the bottom-hole depth. A suitable brine reservoir can be provided in the form of plastic-coated steel tanks or a ground excavation roofed over to prevent dilution of the brine by atmospheric precipitation.

Without brine displacement . . . The cavity can also be operated strictly as a pressure storage container without brine displacement, but it is desirable to maintain a brine level in the bottom of the cavity as a seal against influx of fluids from lower formations. Without the use of brine displacement in the process of product-storage buildup and withdrawal, the required brine reservoir is much smaller; but a control system must be provided to maintain the bottom-hole brine level under varying pressures. There is also a sacrifice of about 10-15% in the use factor of the actual storage volume.

Dehydration . . . The ethylene withdrawn from storage passes through a desiccant chamber, and a pressure controller into the pipe line. Two drying chambers are indicated in Fig. 6 to permit periodic reactivation of the desiccant, but one chamber may suffice, inasmuch as the outflow is intermittent and the reactivation of the drying agent can be performed during interim periods. Ethylene can serve as a stripping medium. It is circulated by a blower and heated in an electric heater, thus avoiding any direct-fired equipment. Compressor and blower are electrically driven, instruments are electrically operated with electric transmission, so that the whole station can be operated by remote control, provided, of course, that the major valves are also equipped for remote control. The reactivation of the desiccant chamber may require

Dallas Firm Claims World's Deepest Slim-Hole Pumper

The world's deepest slim-hole pumper — a 5,000-foot oiler in Cochran County's Buckshot field —was reported completed Monday by Stekoll Petroleum Company, Dallas.

The well, Stekoll No. 1 J. W. Frost, 7-W-PSL, eight miles south of Bledsoe, gauged 139.8 barrels of oil plus 75 barrels of water a day on pump from around 5,140 feet. Slim hole wells produce through 1-inch hollow rods set in 2½-inch casing as opposed to normal casing size of 5½ inches.

M. H. Stekoll, president of the firm, said economy is the primary motive behind the slim well procedure. Savings from such techniques have reached as much as one-half normal costs in shallow depths and one-third in others, Stekoll claimed.

Since 1942, when he began water flooding work in the Bolton field near Independence, Kan., Stekoll has pioneered slim hole production.

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"I chose the Johnston Hydraulic Pumping Unit because of its lower initial cost—and its long, slow stroke protects the 1-inch hollow rods."

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Yes—from Mexico to Canada the Johnston Hydraulic Pumping Units are proving the answer to the demand for "low cost pumping."

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Many deep wells with moderate production can be profitably pumped with only a Johnston Hydraulic Unit. Sizes range from 2 ft. stroke to 12 ft. stroke.

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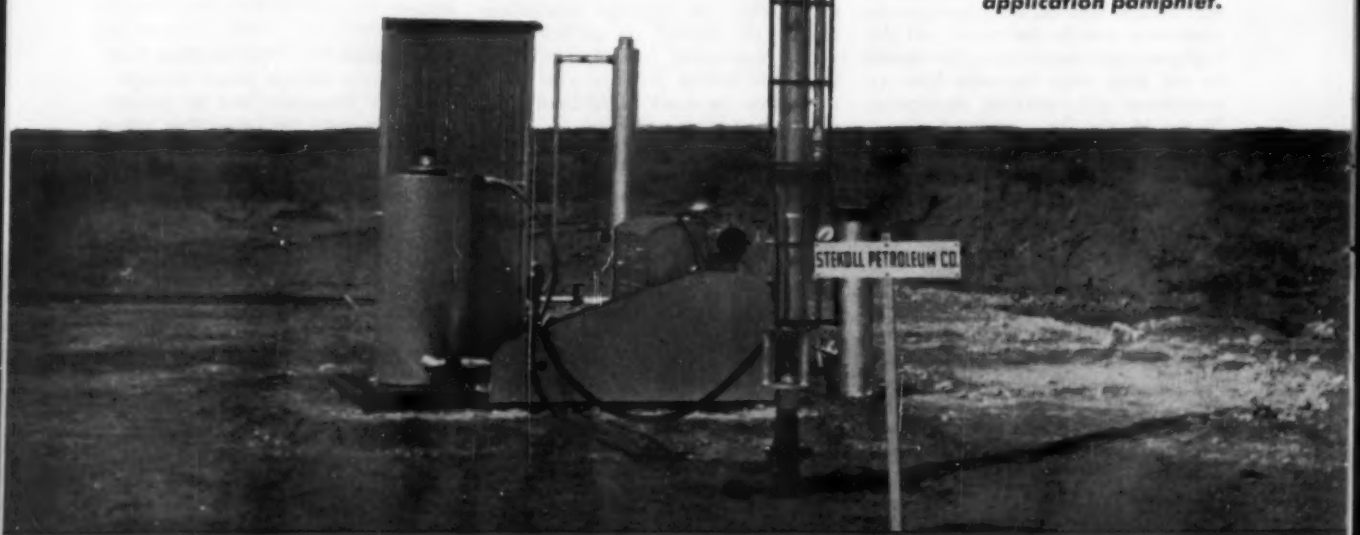

ENGINEERED OIL TOOLS, INC.

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the direct attention of an operator on infrequent occasions.

Washed out cavity costs . . . The installation cost of such storage facilities as are illustrated in Fig. 6 and providing storage for approximately 10,000,000 lb. of ethylene has been reported in the literature[6] at approximately 1.5 to 3.0 cents per pound of storage capacity. Annual operating costs are estimated at 0.08 to 0.16 cent per pound of ethylene if the storage facilities serve a distribution system handling 200,000,000 lb. per year. Of course, these cost figures will vary from case to case, depending on the location of the storage cavern with respect to the production plant and pipeline, as well as the equipment provisions and method of operation.

The question of purity . . . The normal ethylene product quality remains unchanged in storage. There is no increase in impurities. The product withdrawn from storage is, of course, saturated with moisture and therefore must be dried to restore its quality in this respect to the state of its recovery from the ethylene plant.

High-purity ethylene (polymerization grade) . . . The specification for this limits the content of acidic and other gases to trace quantities, high-purity ethylene may pick up small amounts of impurities such as CO_2, N_2, O_2, and the product may not meet the requirements of catalytic conversion processes which are extremely sensitive to these impurities. Also, a slight degree of dimerization may take place in prolonged storage and adversely affect subsequent use of the product. Experience with underground storage of ethylene is relatively limited and it seemingly has not yet been established whether it is suitable for ethylene of very high purity.

Summary on Costs

- The subterranean cavern washed out of salt formations or strata offers really the best means of providing a large ethylene-product reserve at low cost and making the production operation completely independent from the consumer demand. The annual plant turnaround involving complete inspection of all equipment, usually requires a shutdown or interruption of operation lasting at least 10 days. As mentioned previously, storage capacity of lesser magnitude would involve curtailment of ethylene deliveries to various chemical companies and requires a cooperative understanding between producer and consumers.
- The cost studies of storage in insulated tanks or underground pipe or pipe sections, presented previously, has been based on a holding capacity of 4 days' production since the capital outlay involved is considerable and might appear to be prohibitive if increased to provide for 10 days' production of the 600,000 lb. per day ethylene plant.
- A comparison of the three methods should, of course, be based on the same or equivalent storage capacity and Table 5 has been prepared to show the relative costs of the various systems investigated, basing all estimates on a storage capacity of 6,000,000 lb., equivalent to 10 days' production of the ethylene plant.

Dissolved cavern is cheapest . . . It will be noted from this comparison that the dissolved cavern represents the lowest-cost storage installation, especially when it is considered that once a well is drilled and a certain cavity washed out, the size or volume may be increased at very little additional cost merely by continuing the dissolving process. This is provided, of course, that the salt strata are of sufficient thickness to permit a further increase in depth of the cavity. Thus a cavern holding 2 weeks' plant production may cost very little more than the volume on which the cost comparison in Table 5 is based.

TABLE 4—INVESTMENT AND OPERATING COST OF ETHYLENE AND SUBSURFACE PIPE

Design basis:		
Ethyln plant capacity, 1,000 lb./stream day		600
1,000 lb./year		200,000
Storage capacity, lb.		2,400,000
Storage temperature, °F.		60
Storage pressure, psig.		1,440
Design provisions:		
	Pipe sections or bottles	High-pressure transmission line
Pressure in pipeline, psig.	375-250	1,440-1,410
Separate storage	1060—pipe sections 24" o.d., 40' long API Specif. N80	
Pipeline	8" Sch. 20	8" Sch. 40
Investment cost:		
Storage installation complete, incl. land	$1,010,000	
Increase in cost of pipeline (Sch. 20 to Sch. 40)		$310,000
Pumping and sendout equipment	100,000	100,000
Press. reducing equip.		20,000
	1,110,000	430,000
Annual operating cost:		
Depreciation (10% of inv't.)	$110,000	$43,000
Interest, taxes, insurance	84,200	30,000
Utilities and supplies	1,800	8,000
Maintenance	7,500	2,000
Operating labor and overhead	13,500	8,000
	217,000	91,000
Loss in refrigeration		58,000
		149,000
Cost per lb. of C_2H_4 produced; cent	0.12	0.075

TABLE 5—COMPARISON OF INVESTMENT AND OPERATING COSTS OF LARGE ETHYLENE STORAGE FACILITIES

(10 days of plant production: 6,000,000 lb.)

	Investment cost, $	Annual operating cost cent/lb. of C_2H_4	Notes
Insulated tanks (aboveground)	2,850,000	0.27	
Pipe sections (pipe bottles)	2,500,000	0.23	
Oversized high-pressure Pipeline	1,400,000	0.17	Differential between 8" Sch. 20 and 12" Sch. 40 (70 miles).
Dissolved cavern (salt domes)		0.05-0.07	Will vary from case to case.

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PRODUCTION

Fluid injection for oil recovery

What it can do—and can't

As oil-finding costs continue to mount, closer attention is being given to increasing oil reserves through better recoveries from known reservoirs. Fluid-injection methods can do this. There are many types of reservoirs and no one fluid-injection method is best for all of them. The authors point out the general characteristics where each fluid-injection method is applicable, and what its limitations are. Thus those most likely for a specific field can be chosen for studies.

This article was presented as a paper at the eleventh annual TPRC meeting in Austin. George Roberts, Jr., is manager of research department and T. M. Geffen is research group supervisor for Pan American Petroleum Corp., Tulsa.

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T. M. GEFFEN

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Pan American Petroleum Corp., Tulsa

GAS INJECTION as usually employed allows a gradual reservoir-pressure decline. This has important effects in low-conformance reservoirs. The pressure decline allows gas to come out of solution in the bypassed portion, thus expelling oil into the swept pore spaces from where it can be driven to the producing well. Gas cycling in low-pressure operations promotes gasoline and LPG recovery through vaporization of lighter components of the reservoir oil into the flowing gas stream. This benefit is usually a valuable supplement to the oil production.

Conventional gas injection or pressure maintenance has been used successfully for many years. Two general methods of gas injection are used: dispersed and crestal injection. The dispersed type is most beneficially applied to gently dipping reservoirs such as are found in many West Texas fields. Crestal injection appears ideally suited for high relief reservoirs such as are found in the Rocky Mountains and the Gulf Coast area.

Dispersed gas-injection operation can yield about half again as much oil as is produced by solution-gas drive. A representative recovery value for solution-gas drive is about 20% of the oil in place, so that an additional 10% may be recovered by gas injection. About 5 M.s.c.f. of gas will usually have to be injected for each additional barrel of oil recovered.

Effects of Density Difference

The limited low incremental recovery beyond primary recovery is mainly due to the immiscible nature of the gas and reservoir oil and to the large contrast in their densities and their viscosities. The first of these features results in low displacement efficiency. The contrast in density and viscosity acts to produce a low volumetric-sweep efficiency.

The effects of density difference can be used to an advantage by injecting the gas in the high parts of the structure. Thus, gravity can be used to keep the gas "floating" above the oil and provide circumstances favoring high recovery efficiency.

Crestal gas injection into a reservoir provides a more efficient use of the gas and can give total recoveries ranging from about 50% of oil in place for a reservoir with 15° dip to about 70% for a reservoir with 25° dip. Without gas injection the recoveries might range, respectively, from 45% for 15° dip to 65% for 25° dip. Profit increases by crestal gas injection are related to sustained producing rates and thus reduced field life.

Any injected gas will probably segregate, because of its low density, in most applications. Where structural dip permits producing oil at downdip locations, gas injection may prove to be the ideal and ultimate fluid for injection. Even in flat reservoirs not stratified by many impervious streaks, segregation may favorably influence oil productivity. However, the adverse ratios of gas-to-oil mobility prevents economic recoveries much higher than 30% under current field practices. Special well completion and injection programs might in the future improve recoveries over those attainable with present-day techniques.

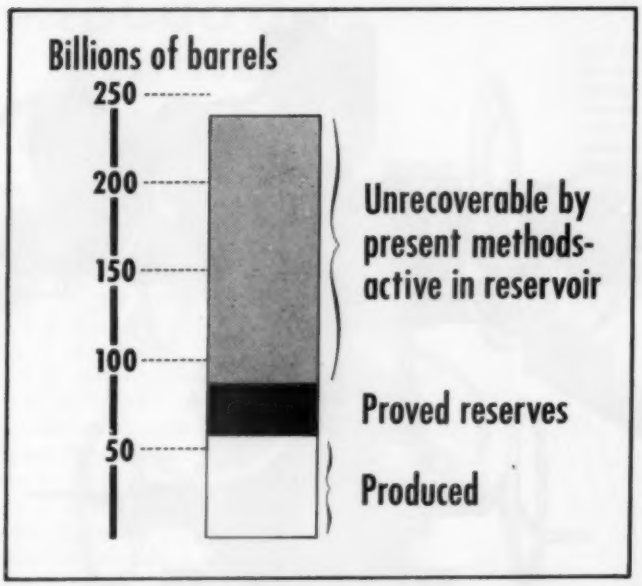
Gas injection is frequently not the ultimate solution to maximum recovery. However, it may serve as an important economic intermediate step in conservation. In addition to increasing ultimate recovery, it provides means to conserve gas, extend high-oil-productivity life, and minimize artificial-lift requirements.

Other Uses of Gas Injection

Gas injection can also be used to obtain a better understanding of interwell pore-space geometry. This information may provide a basis for considering other fluid-injection programs. Gas injection, for example, will often permit quantitative determination of conformance factor, indicate the possible extent of gravity segregation of fluids, reveal the approximate degree of lateral continuity of permeability profiles, and also provide information on which to base a better estimate of oil in place in various areas of a large reservoir.

Gas injection with a controlled pres-

Today's Crude-Oil Picture



ABOUT 240 billions of barrels of oil have been found to date in the United States. Of this, about 50 billion have been produced and about 30.4 billion are the present proved reserves. This leaves about 152 billion barrels as unrecoverable by methods now used.

sure-decline program might be planned as a step specifically to precede water flooding. The presence of this gas phase at pressures near the level of water-flooding pressure can significantly increase oil recovery. This has been demonstrated in the laboratory in water-flooding reservoir cores. It has been found that gas can fill parts of the pore space otherwise left full of oil not recoverable by water displacement.

Other conditions permitting, crude oils of approximately 30° API gravity and higher are best suited for applications of gas injection as an oil-recovery method. It is recognized, however, that ultimately a subsequent fluid-injection program might be employed to achieve even more oil recovery.

Improved Gas Drives

Improved gas-drive methods, in which the reservoir is "dry cleaned" of its oil, have been laboratory tested and are now being extensively field tested. These methods use high-pressure gas or LPG, with or followed by dry gas, to create a scavenging "solvent" bank in the reservoir. This can result in higher displacement efficiencies and therefore higher oil recoveries than can be obtained with conventional gas drives or water floods. Other solvents, such as alcohol and acetone, which are miscible with both oil and water, would be attractive except for their excessive cost on the current market.

The reason for this improved recovery is the elimination of capillary forces inherent in two-phase systems. The solvent bank is forced to move through oil-saturated zones, driving essentially all the oil contacted forward to producing wells.

A solvent bank can be created in several ways. These are divided into three types for this discussion:

1. **Miscible slug.** Liquid propane, or possibly butane, can be injected to form a bank. This bank will amount to between 2 and 10% of the hydrocarbon pore volume involved. The bank is followed by dry gas under sufficient pressure at the reservoir temperature to maintain miscibility between the driving gas and the solvent.

2. **Enriched gas.** A "partial" solvent bank, which is not necessarily completely miscible with dry gas, can be created by enriching (with LPG constituents) the injected gas in a gas-injection operation. As this rich gas contacts reservoir oil, it loses LPG, thus swelling the oil and reducing its viscosity.

After a sufficiently large bank of LPG-enriched oil is established in the reservoir, dry gas alone may be injected. This dry gas will, through vaporization of LPG constituents from the crude it first contacts, carry these forward to crude of lower enrichment. In this way a bank of LPG rich crude can be moved through the reservoir at a rate of advance less than that of the dry gas.

3. **High-pressure gas.** Another type of solvent bank or its equivalent can be created by the injection of gas at pressures substantially above the saturation pressure of the reservoir oil. Transfer of components to and from the injected gas and reservoir oil can create a miscible zone between the injected gas and the liquid hydrocarbon.

In the first and third types, complete miscibility is obtained between the driven crude oil and the driving gas. Where this is accomplished, essentially 100% of the crude oil will be removed from the pores swept by the solvent bank.

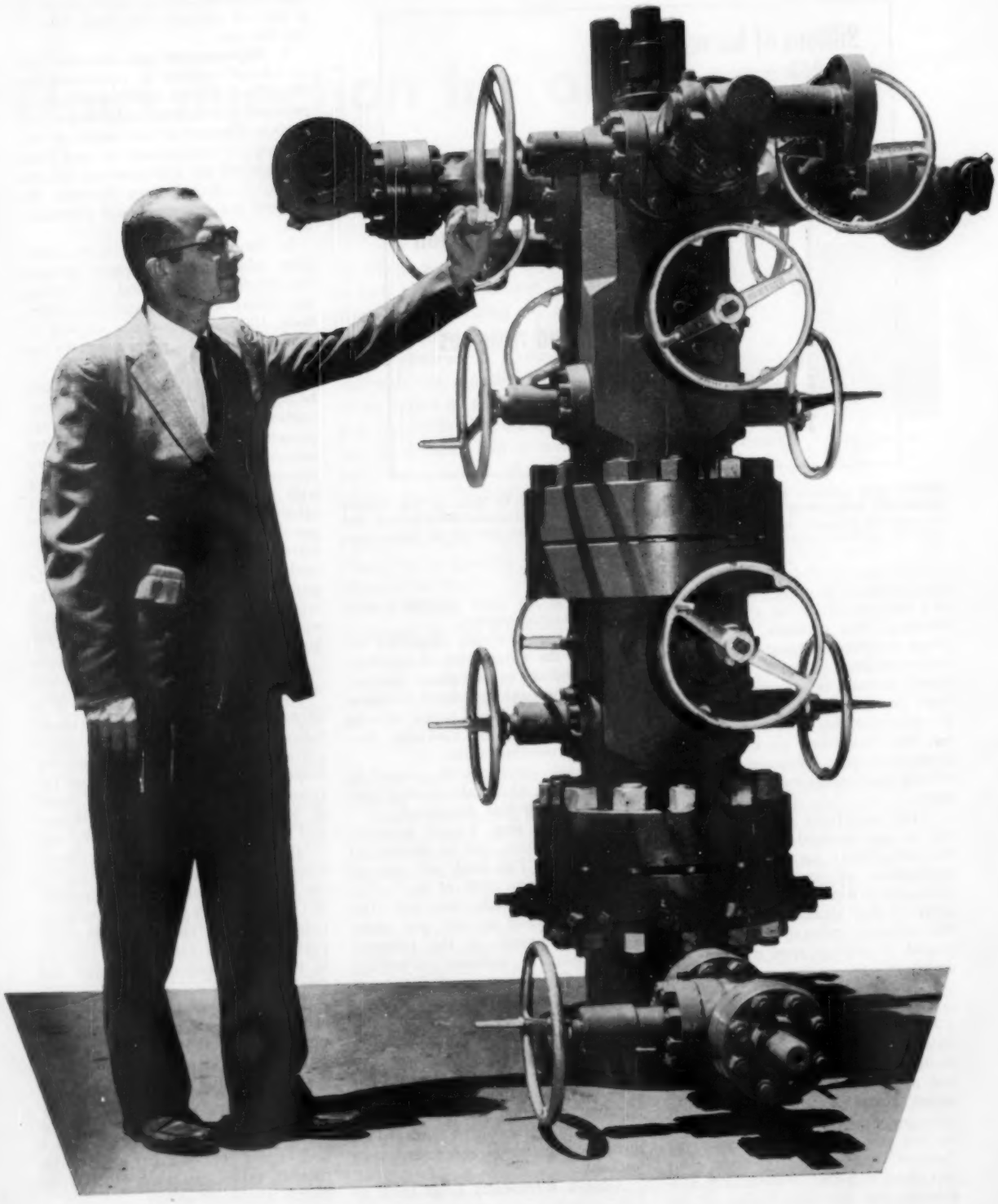
In the second type, recovery can be significantly greater than from conventional gas drive and can even approach that achieved with complete miscibility. Thus, almost any level of recovery efficiency (up to that possible with complete miscibility) can be achieved by employing an improved gas drive (or solvent flood). In reservoirs where these methods are applicable, the primary recovery would probably average about 20% of the original oil in place. A solvent flood would probably recover an additional 50% of the original oil in place.

Miscible Slug

For miscible slug to work, it is necessary that a solvent bank be established and displaced through a major portion of the reservoir involved. Some factors, combined with an unfavorable mobility ratio, can result in low volumetric sweep efficiency and conformance. Mobility is the ease of flow of a fluid through a porous material and is numerically equal to the ratio of the effective permeability (K) in millidarcys to the fluid in question to the fluid viscosity (μ) in centipoises. Mobility ratio is the contrast in mobility between the driven and driving fluid.

The mobility of both gas and LPG behind the front may be 50 to 100 times that of the oil being driven. Thus, even moderate contrast in permeability profile may result in bypassing of oil. Also, gravity segregation of solvent and gas relative to the more dense crude oil can take place and, again, because of unfavorable mobility ratios, can result in low volumetric sweep efficiency.

The miscible slug process should be applicable in formations with less than about 25 ft. of continuous vertical permeability of less than about 100 md., with no thin high-permeability streaks, and with other factors lead-



4 PARALLEL PRODUCTION STRINGS

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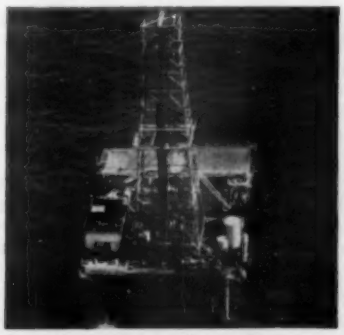
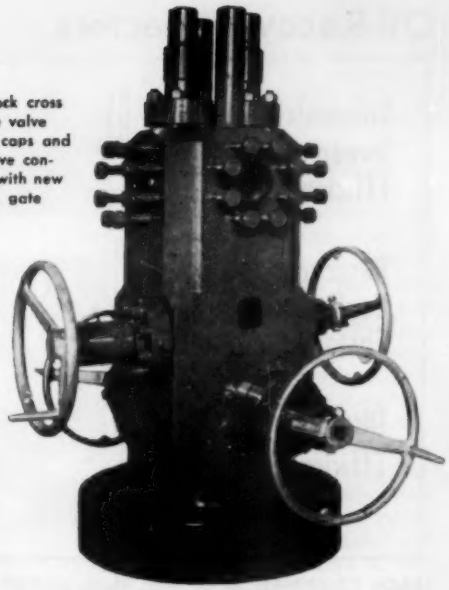
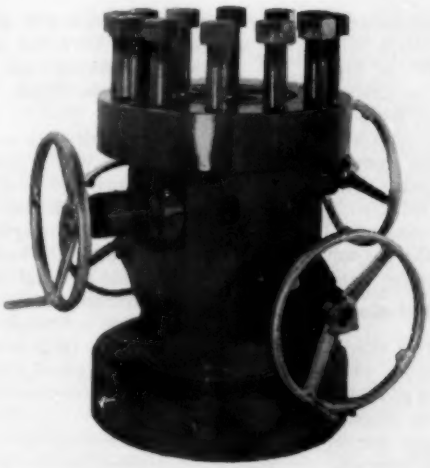


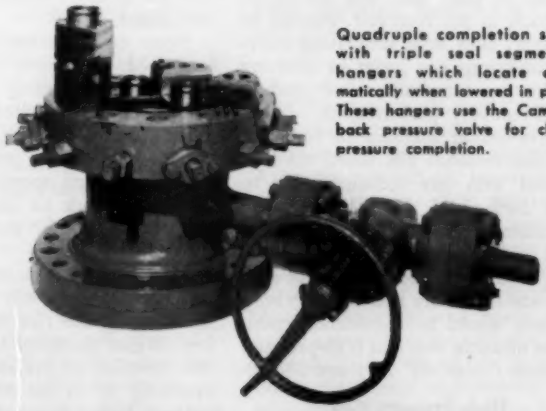
* *Oil industry's first 4 parallel string quadruple zone completion by CATC Offshore Group. Completion date June 19, 1958.*



Solid block cross type tree valve showing caps and wing valve connections with new Cameron gate valves.



Solid block quadruple string master valve with new Cameron gate valves.



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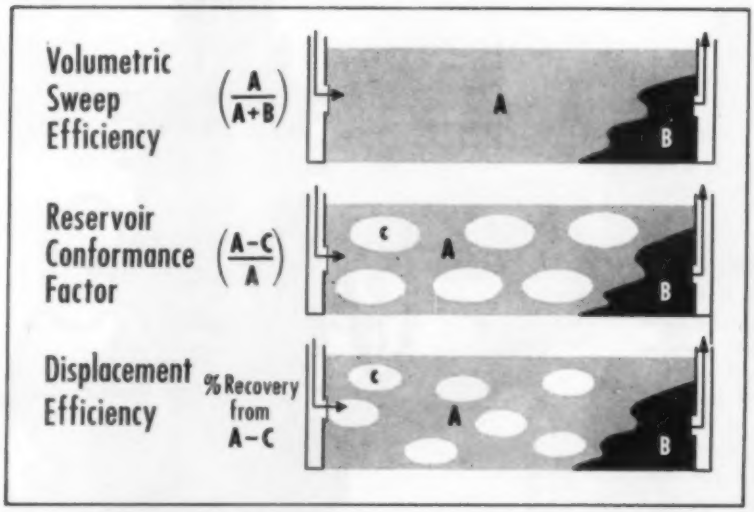
Oil-Recovery Factors



EACH COMBINATION of rock, fluid, and structural properties will result in a different oil recovery. The recovery is determined by the three factors listed at left in this chart. Oil recovery is a function of the product of these three items.

ing to high conformance. The formation should contain oil having a gravity of 40° API or higher.

Some of these favorable conditions can be sacrificed if there is sufficient structural relief to help keep the solvent bank pressing generally downward on the oil phase. The reservoir must be located sufficiently deep to hold gas of approximately 1,300 psi. gage pressure at the gas-solvent (propane in this instance) contact.

Enriched Gas

Enriched-gas drive should be operable in any reservoir where conventional gas drive has proved to be effective. The optimum amount of LPG to add to the gas stream depends principally on the reservoir temperature and pressure, the composition of the reservoir fluids, the gas-cycling capacity of the plant, and the liquid saturation in the reservoir. Results of laboratory flow tests simulating reservoir conditions can assist in selecting injection-gas composition and predicting oil-recovery performance.

An optimum increase in recovery over conventional gas drive may be achieved with gas containing up to 40 or 50% LPG by volume. Since continuous gas cycling is usually associated with this process, the method may prove economic with lower-conformance reservoirs and lower-gravity oils than would be considered essential for miscible slug and high-pressure gas drives (about 40° API and above).

High-Pressure Gas

To achieve miscibility, high-pressure gas-injection prospects usually require considerable depth (generally more than 5,000 ft.) and a large volume of makeup gas. The reservoir oil should be highly undersaturated with gas.

An example of a suitable reservoir may be one with a discovery pressure of 4,000 psi. and a bubble-point pressure of 2,500 psi. Gas injection would start before the reservoir pressure declines below the bubble-point pressure of the original oil in place.

This method, compared to miscible slug, should not result in as low volumetric sweep efficiency. This is because mobility and density differences at high pressures are less than at low pressures.

Oil gravity of 40° API and above is preferred. In this process complete miscibility can be achieved at lower pressures than required when using dry gas if some ethane and propane are added.

None of the above three types of improved gas drives preclude subsequent water flooding if they should fail to achieve desired results. Conversely, water flooding prior to application of improved gas drives should not prevent their operability. However, less oil to work on and the handling of produced water may seriously reduce profit.

Methods for improving volumetric sweep efficiency will aid materially in reducing the risk factor in applying solvent flooding. One proposal is the injection of gas and water simultaneously or in the form of slugs to achieve better volumetric sweep efficiency than is realized by gas injection alone.

The economics must be thoroughly analyzed whenever LPG or high-pressure gas might be used successfully to increase oil recovery. In both cases the cost of LPG and/or makeup gas may require a high capital investment as compared to water flooding, and its added contribution may come in the form of productivity and added reserves to be realized only many years in the future.

Water Flooding

Water flooding has been applied successfully for many years and is probably the most used present-day method. As now practiced, the principal variations involve differences in well arrangements.

The most frequently used arrangement is the five-spot which provides about one injection well for each producer. This arrangement can realize high oil-recovery rates.

The peripheral arrangement of wells (injection wells surrounding oil reservoir) is being used more frequently in recent years. This type flood pattern is thought to provide conditions which should result in producing a minimum amount of injected water with the produced oil.

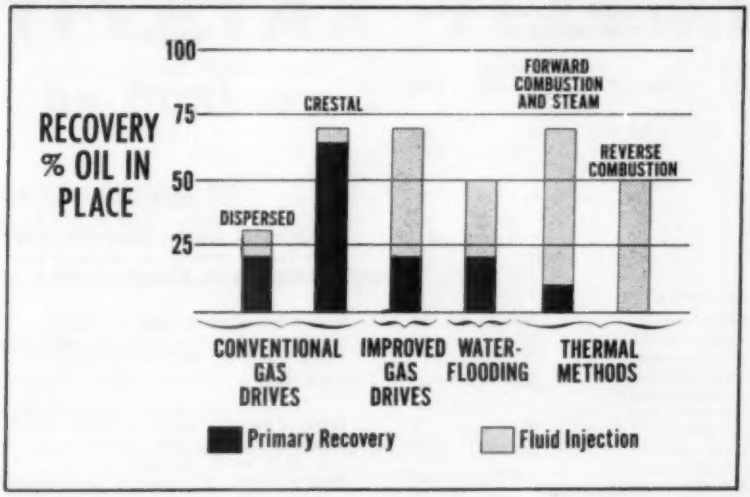
At the same time there is generally a delay in buildup of producing rate with peripheral flooding because less oil is affected by pressure buildup during early stages of injection. Quite often an entire region of high oil saturation must be surrounded by water injection in a peripheral flood. This minimizes transfer of oil into areas of low oil saturation, such as gas caps.

From field results it appears that water flooding best applies to reservoirs containing oil with a gravity greater than 25° API. It is not unusual to recover as much oil by water flooding as was recovered during a reservoir's primary life. In some cases one and a half times as much more oil may be recovered.

Primary recovery from fields which are good water-flood prospects can generally be about 20% of the original oil in place. The additional oil by water flooding could be as much as 30% of the original oil in place. In recovering this oil as many as 20 bbl. of water may often have to be injected for each barrel of oil produced.

Volumetric sweep efficiency is usually high in water flooding. The ratio of the mobility of the injected water relative to that of the reservoir oil is favorable. This will tend to smooth the vertical profile of water movement, even though layers of different permeability exist. Also the favorable mobility situation results in

Summary: Oil Recoveries vs. Method



OIL that might be produced under primary depletion is shown here, together with the added oil that might be realized through the use of the particular fluid-injection method.

areal spreading of the water. Conformance associated with water flooding can be helped by the capillary forces present which may result in imbibition of some of the water that is moving through more permeable streaks into tighter, previously bypassed zones. This permits recovery of oil which might otherwise be bypassed.

The capillary forces which are helpful in improving conformance also cause reduced displacement efficiency. This is because globules of oil become trapped by water in the pores of the rock. This amount of trapped oil is different for different rocks and is usually in the range of 15 to 50% of the pore space.

Although the mobility contrast in water flooding is favorable for high volumetric sweep efficiency, it may sometimes result in a low water-injection rate and therefore a low oil-production rate. This is particularly true in the tighter and thinner pays. Proper applications of hydraulic fracturing can be used to minimize this apparent limitation.

In the future, improvements can possibly be realized in water-flooding displacement efficiency. Determination of the degree to which the rock is preferentially wet by oil or water, and possible modifications in the wetting, are among the current problems facing reservoir mechanics research.

Addition of inexpensive chemicals to the flooding water, such as acids, bases, or surfactants, which alter the capillary or surface forces, may prove valuable for wettability control and thus realize more oil recovery.

Heat energy can under certain conditions improve the efficiency of oil recovery when using fluid injection. The processes to be discussed include those in which a heat bank is driven through the formation from well to well.

The specific methods to be discussed are: (1) Forward combustion, (2) reverse combustion, and (3) steam-combustion gas.

These three methods have some common features. Permeability to gas has to be established between wells so that the heat bank can be propagated. The heat bank increases the mobility of reservoir hydrocarbons, either by vaporization, cracking, viscosity reduction, or a combination of these. The reservoir fluids, with increased mobility, are driven to producing wells by a high rate gas drive supported in some instances by the development of partial water bank formed from connate water and products of combustion.

About a dozen pilot tests of at least two of these thermal recovery processes have been completed or are under way. No project approaching field-wide scale has been announced.

Forward Combustion

In forward combustion, air, sometimes altered in oxygen concentration, is injected into the center of a five-spot or other well arrangement. A combustion zone is propagated radially from the injection well outward to the production wells. Forward combustion is most applicable to the recovery of oils in the gravity range from about 15° to 25° API.

Oils having a gravity above 25° API are usually more suitable to some other type of fluid injection. Oils having a gravity below 15° API would likely plug the gas-filled pore spaces ahead of the combustion zone and slow down the process below desirable working limits.

In general, the injected air requirements will be 10 M.c.f. to 20 M.c.f. per barrel of produced oil. Temperatures approaching 800° to 1,200° F. will prevail in the combustion zone. It is estimated that about 10% of the oil originally in place will be consumed as fuel. Probably 60 to 70% of oil originally in place can be recovered by forward combustion where this method is feasible.

It is believed that forward combustion will be most economical in reservoirs with rock porosity of about 15% or higher. High porosity means lower ratios of injected air to produced oil because less rock need be heated and so more oil can be recovered. In forward combustion the flow rate of fluids is limited because of the mutual interference in the simultaneous flow of oil, gas, and water.

"Rules of thumb" for estimating whether economic producing rates can be obtained are:

1. For reservoirs about 500 ft. or deeper, the ratio of the reservoir permeability in millidarcys times pay thickness in feet divided by oil viscosity in centipoises should equal about 30 or more.

2. For reservoir depths less than about 500 ft. (with closer well spacing), the value should be at least 15. If the reservoir is divided into zones of perhaps 10 to 20 ft. in thickness, some operating problems may be simplified in accomplishing desired vertical distribution of the combustion zone.

Problems of well control to promote better volumetric sweep efficiency, and completion methods to withstand high temperatures will become important as forward combustion moves into practice.

Reverse Combustion

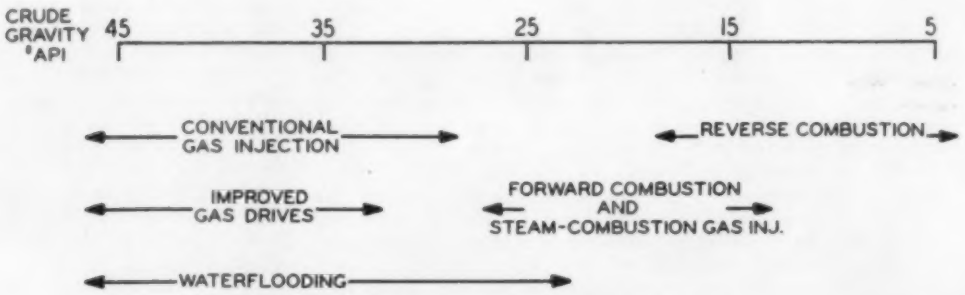
In reverse combustion, air would likely be injected into the center of a five-spot or other well arrangement. After the injected air breaks through to the production wells, the reservoir mixture is ignited at the production wells and allowed to burn in the direction toward the air-injection well. Oil is recovered by vaporization and thermal cracking, and passes mostly in the vapor phase through the already burned-out hot formation to production wells. This is in contrast to movement through a cold zone in forward combustion.

Reverse combustion is believed most

Fluid Injection for Oil Recovery—Applications and Limitations

Type of injection—	Oil gravity where most applicable	Expected degree of recovery (per cent oil in place) Primary*	Additional by fluid injection	Total	Special considerations for preferred applications
Conventional gas injection:					
Dispersed	Above 30°	20	10	30	
Crestal	Above 30°	45–65	5–25	50–70	Dip 15° or higher.
Improved gas drives:					
Miscible slug	Above 40°	20	50	70	Thin (25 ft.), less than 100 md. perm., no high perm. streaks. Depth >2,500 ft.
Enriched gas	Above 40°	20	20–50	40–70	A good conventional gas drive under way.
High-pressure gas	Above 40°	20	50	70	Large volume makeup gas needed at high pressure. Depth generally >5,000 ft.
Water flooding:					
Pattern	Above 25°	20	30	50	Knowledge of preferential wettability.
Peripheral	Above 25°	20	30	50	As above. Avoid moving oil regionally into areas of low oil saturation, e.g., gas caps.
Thermal methods:					
Forward combustion	15° to 25°	10	60	70	Effect of viscosity, perm., and depth control max. prod. rate. Res. divided into 10 to 20-ft. zones. Porosity >15%.
Steam injection	15° to 25°	10	60	70	
Reverse combustion	5° to 15°	0	50	50	Need to create air perm. by inj., division of res. into 10-20-ft. zones.

*Solution gas-drive reservoirs.



CRUDE GRAVITY vs. success of fluid-injection methods.

applicable for the recovery of heavy oils and tars in gravity range from about 5° to 15° API. The produced oil may be upgraded in gravity by cracking to 20° API or higher. Also it might be a superior refinery stock since it will be deficient in the light and in the very heavy hydrocarbons.

Laboratory studies of the reverse combustion method have indicated it to be operable. It is not yet known whether reverse combustion can be economically applied as a recovery method. No field tests of this process are known to have been conducted.

If this process is found to be operable for field use, it is believed about 50% of the oil in place might be recovered. It is thought that in most places where this method may be used there will have been no primary oil recovery of significance. Air-injection ratios varying from about 15 M.s.c.f. to 30 M.s.c.f. per barrel of produced oil will probably be experienced.

In applications of reverse combustion, air permeability might have to be created by displacing connate water unless a gas phase is present. Air permeability might be achieved by creating a fracture, perhaps along bedding planes, and holding it open by air pressure. This would only be necessary if there were little or no mobility of the reservoir fluids in place.

After air circulation is established, it is necessary that the oxygen content of the injected air not be reduced by contact with the oil to interfere with the combustion reaction, which has to be initiated at the producing well.

It is expected that a preferred reservoir characteristic will be that the formation is divided into zones 10 to 20 ft. thick. This may aid in the control of the vertical distribution of the combustion zone.

Steam-Combustion Gas

Steam, because of its high latent heat and its adaptability for injection, offers perhaps the best-known means for introducing into a reservoir heat generated at the surface. Such a process would work best under conditions where forward combustion would be feasible. In fact, the published[2] results of a recent field test of steam-combustion gas injection indicated that the heat supplied to the reservoir came partly from the injected gases and partly from a combustion reaction in the formation.

Forward combustion appears to offer several advantages over steam. Less heat is required because residual heat is continuously transferred forward in combustion; crude oil in the reservoir (perhaps the heaviest, least marketable ends) supplies the fuel; and surface equipment is less expensive.

At present the use of steam as described herein does not appear to have enough advantage over other thermal methods to warrant its use. Field experience with thermal methods might at some time prove otherwise.

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TELETAX TELEMETERING

Here's a New way to determine chlorides

in charge to catalytic reformer

BY CHARLES PETTY AND ROBERT KUNG
La Gloria Oil & Gas Co.

SERIOUS reformer catalyst damage and product-yield loss have occurred in the Texas-Louisiana area during the past 6 months. The cause of this damage and loss has been traced to organic chlorides in the reformer fraction of crude oils.

All of the more common organic chlorides have the same boiling range as most reformer-charge fractions.

A reformer charge contaminated with organic chloride was separated into six fractions, and the chloride content of each fraction was determined. Table 1 shows how the chloride was distributed in this sample. Examination of the properties of the more common organic chlorides (Table 2) indicates that the chloride in this reformer fraction is trichloroethylene.

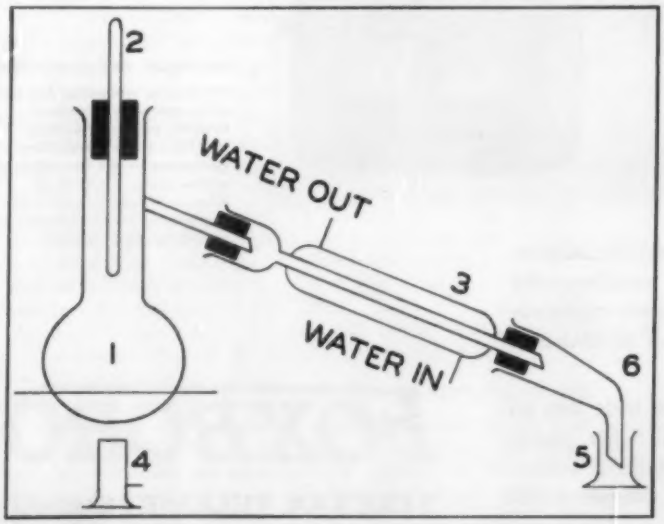
Reformer-charge fractions, boiling between 160° and 360° F., were separated from over 30 different crude-oil samples and analyzed for chloride. The chloride content of these samples ranged from less than 1 p.p.m. to over 500 p.p.m. Eight samples contained over 10 p.p.m., which is much higher than the 1-to-3 p.p.m. ordinarily used in reformer (Platformer) operations.

TABLE 1—CHLORIDE DISTRIBUTION IN REFORMER CHARGE

	Reformer charge	Fraction 1	2	3	4	5	Residue
Boiling range, °F.	120-400	120-158	158-184	184-212	212-230	230-248	248-410
Per cent of total	100	3.25	13.6	9.65	9.4	8.35	55.75
Chloride, p.p.m.	10.5	16.4	41.5	43.0	27.8	8.8	1

TABLE 2—PROPERTIES OF SAME ORGANIC CHLORIDES

	Mol.-wt.	Boiling point, °F.	Specific gravity	Per cent chloride
2,2-Dichloropropane	158	158	1.093	62.75
1,1,1-Trichloroethane	133.3	165	1.325	79.78
Carbon tetrachloride	153.8	172	1.591	92.20
Trichloroethylene	131.3	194	1.440	81.00
1,1,2-Trichloroethane	133.3	237	1.457	79.78
Tetrachloroethylene	165.8	250	1.631	85.52
S-Tetrachloroethane	167.8	297	1.614	84.50
1,2,3-Trichloropropane	182.8	311	1.417	58.18
Pentachloroethane	202.3	322	1.693	87.66



DISTILLATION apparatus used in analyzing for both organic and inorganic chloride. Fig. 1.

Problem solved . . . One of the main problems in finding the sources of contamination and controlling chloride concentration in reformer charge was to find an accurate, reproducible method of analyzing for organic as well as inorganic chlorides. Using the ASTM method, "Chlorine in Lubricating Oils D-1317-54T," as a basis, the method presented here was developed to analyze for both organic and inorganic chloride.

This method depends on the reaction of organic chloride with metallic sodium in an alcoholic medium to form sodium chloride. The sodium chloride is extracted with 10% nitric acid and water. After concentration of the aqueous extract, alcohol is added and the sample titrated with 0.01 N alcoholic silver nitrate.

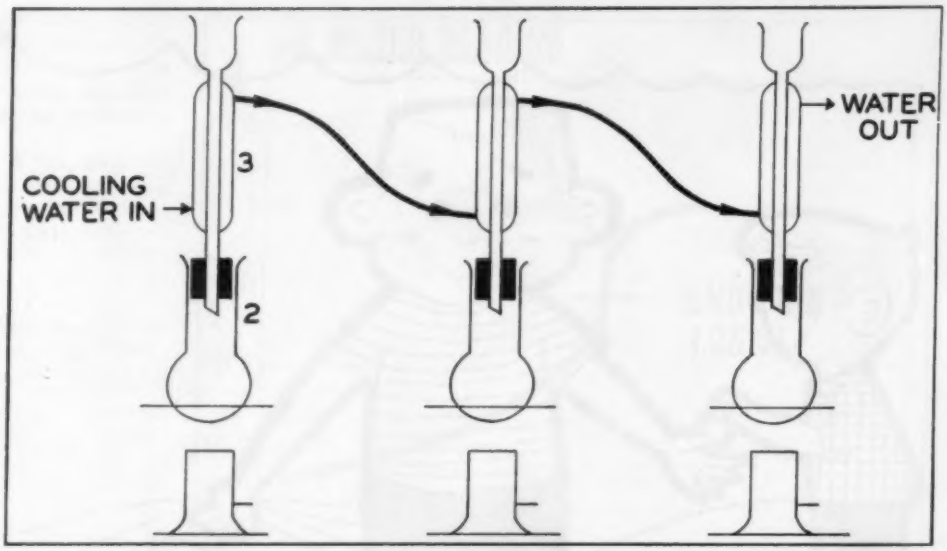
The end point is taken from a titration curve obtained by using a pH meter equipped with a glass electrode, silver-silver chloride electrode system.

Apparatus

Distillation apparatus required is: (1) distilling flask, 500 ml.; (2) thermometer, ASTM 580° F.; (3) Liebig condenser, 24 in.; (4) Bunsen burner; (5) graduates 200 ml., 100 ml.; and (6) adapter condenser. This is shown in Fig. 1.

Reaction apparatus need is: (1) Bunsen burner; (2) Kjeldahl flask, 300 ml.; and (3) Liebig condenser, 24 in. This is shown in Fig. 2.

Titration apparatus utilizes: (1) Beckman Model H-2 pH meter; (2) glass reference electrode; (3) silver-silver chloride electrode; (4) titration beaker, 250 ml.; (5) automatic microburette, 5 ml., graduated in 0.01 ml. subdivisions; and (6) brown bottle for silver nitrate solution, 3-liter. This is shown in Fig. 3.



REACTION apparatus used in chloride analysis. Fig. 2.

Reagents include: distilled water, chloride-free; metallic sodium, reagent grade; normal butyl alcohol, reagent-grade; methyl alcohol, reagent-grade; mixture of 50% methyl alcohol, reagent-grade, and 50% isopropyl alcohol, reagent-grade; nitric acid, reagent-grade, 10% solution; and silver nitrate 0.01 N alcoholic.

The silver nitrate (1.6989 g.) is dissolved in 90 ml. of chloride-free water and diluted to 1 l. with reagent-grade isopropyl alcohol.

Procedure

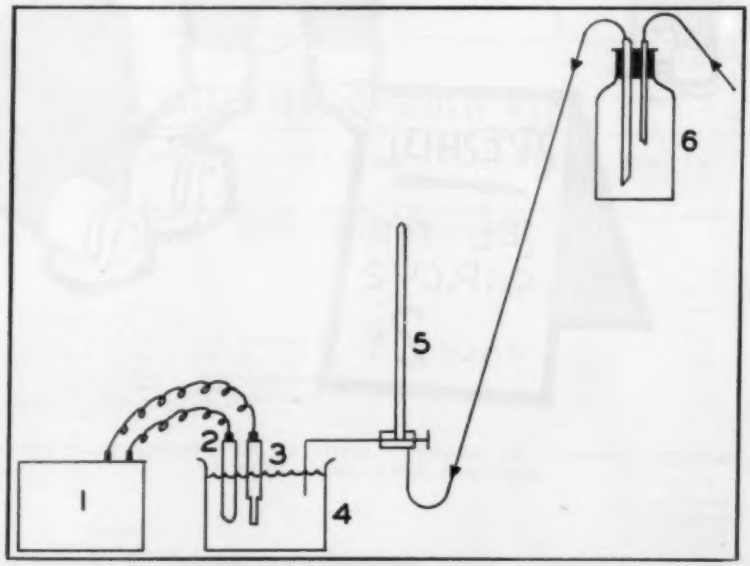
This procedure can be divided into three steps. Step 1 is necessary only when crude oils or other samples that require the separation of a reformer-charge fraction are to be analyzed.

Step 1—Distillation . . .

Four hundred milliliters of crude is charged to the distilling flask. The thermometer is fitted into the flask so that the bottom of the mercury bulb is just below the side-arm opening. After the flask has been fitted to the water-cooled condenser and a 100-ml. graduate put in place as a receiver, the sample is heated with a low flame or other source of low heat.

The sample is distilled at the rate of 3 to 5 ml. per minute until the vapor temperature reaches 160° F. When this temperature has been reached, the 100-ml. graduate is replaced with a 200-ml. graduate.

The distillation is continued at the same rate until the vapor temperature reaches 360° F. This 160° to 360° F. fraction is filtered through coarse filter paper to remove excess moisture and then used as a sample in the following steps.



TITRATION apparatus used in the analysis procedure for chlorides. Fig. 3.

Step 2—Reaction . . .

The API gravity of a sample of reformer charge is taken and converted to specific gravity. One hundred milliliters, at 60° ± 5° F., of sample is measured with a 100-ml. graduate and poured into a 300-ml. Kjeldahl flask. Five milliliters of n-butyl alcohol and 0.3 ± 0.05 g. of freshly trimmed sodium is added to the flask.

The water-cooled condenser is fitted to the flask, and the mixture heated with a low flame. The mixture is refluxed at a moderate rate for 1 hour. Twenty milliliters of n-butyl alcohol is added through the condenser, and the refluxing is continued until all sodium is gone. Fifteen milliliters of distilled water is added through the condenser, and the solution is cooled to room temperature.

Step 3—Titration . . .

The solution in the Kjeldahl flask is transferred to a clean dry 250-ml. beaker. The flask is rinsed with 15 ml. of methyl alcohol and the rinse added to the beaker. A second rinse of 10 ml. of methyl alcohol is added to the beaker.

The tips of the silver-silver chloride electrode and glass reference electrode are submersed in the contents of the beaker. The solution is stirred and 5 ml. of glacial acetic acid is added to the beaker. The stirring is continued and 0.01 N alcoholic silver nitrate is added 0.1 ml. at a time. Near

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the end point the pH meter reading is taken 1 to 2 minutes after each 0.1 ml. addition of silver nitrate. The maximum pH meter needle deflection between 0.1 ml. additions is taken as the end point.

A reagent blank is run using isooctane as the sample and following the regular procedure. The blank is subtracted from the total milliliters required for the sample and the remainder is the net millimeters of $AgNO_3$.

Results of a typical titration are shown in Fig. 4, based on the following data:

ml. of 0.01 $AgNO_3$	pH Meter reading	
0.0	9.8	
0.10	9.8	
0.20	9.9	
0.30	9.9	
0.40	10.0	
0.50	10.0	
0.60	10.1	
0.70	10.2	
0.80	10.3	
0.90	10.4	0.2
1.00	10.6	0.7
end point		
1.10	11.3	0.2
1.20	11.5	
1.30	11.5	

Calculations

$$\text{P.p.m. chloride} = (\text{net ml. of } AgNO_3) \times (\text{normality of } AgNO_3) \times 354.5 \times \frac{100}{\text{specific gravity} \times \text{ml. sample}}$$

For 0.01 N $AgNO_3$ and a 100-ml. sample:

$$\text{P.p.m. chloride} = \text{net ml. of } AgNO_3 \times \frac{3.545}{\text{specific gravity of sample}}$$

Experimental . . . The accuracy of this method was tested by adding known amounts of 1,1,1-trichloroethane to isooctane by diluting a reformer charge sample containing 10 p.p.m. of total chloride. Tables 3 and 4 show the results of these analyses.

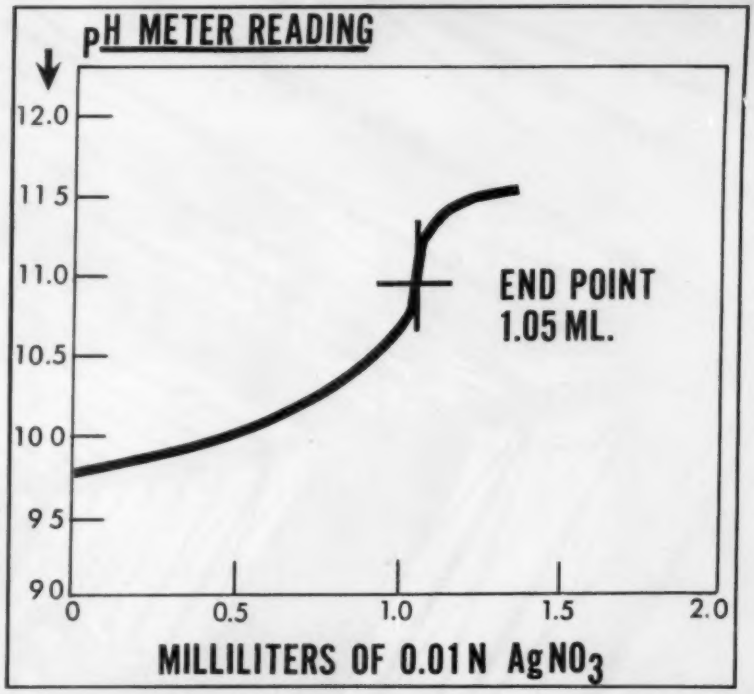
TABLE 3—DETERMINATION OF ORGANIC CHLORIDE IN ISOOCTANE

No.	P.p.m. chloride added	P.p.m. chloride found
1	23.3	23.1
2	10.0	10.5
3	7.5	7.0
4	3.5	3.1
5	1.0	1.3

Chloride as low as 0.5 p.p.m. was detected and the method was accurate to 0.05 p.p.m. on the samples tested.

The reproducibility of this method was tested by analyzing a reformer-charge sample taken from a 20,000-bbl. storage tank and by analyzing reformer-charge fractions separated from crude oil by distillation. The results of these analyses are shown in Table 5. The reproducibility was within 0.5 p.p.m. on sample tested.

Special note . . . Sulfide and/or mercaptans interfere with the chloride titration. Sulfides will deposit a sulfide coat over the silver-silver chloride coating and render the silver-silver chloride electrode ineffective for further titrations.



RESULTS of a typical titration. End point was 1.05 ml. of 0.01 N $AgNO_3$. Fig. 4.

TABLE 4—DETERMINATION OF TOTAL CHLORIDE IN REFORMER CHARGE DILUTED WITH ISOOCTANE

No.	Sample—	P.p.m. chloride calculated	P.p.m. chloride found
1	Reformer charge		10
2	50% of No. 1; 50% isooctane	5.0	5.5
3	30% of No. 1; 70% isooctane	3.0	3.0
4	10% of No. 1; 90% isooctane	1.0	1.3
5	5% of No. 1; 95% of isooctane	0.5	0.25

TABLE 5—DETERMINATION OF TOTAL CHLORIDE IN REFORMER CHARGE AND REFORMER-CHARGE FRACTIONS

No.	Sample—	P.p.m. chloride found
1	Reformer charge	10.1
1a	Same as No. 1	10.8
1b	Same as No. 1	10.2
1c	Same as No. 1	10.0
2	Reformer-charge fraction from Crude Oil A	3.0
3	Reformer-charge fraction from Crude Oil A	3.0

If mercaptans and/or sulfides are present in the sample they can be converted to noninterfering compounds. This is done by adding 5-10 ml. of 10% propylene oxide in methyl alcohol instead of the 5 ml. of methyl alcohol after all the sodium is gone and refluxing for an additional 15 minutes.

Acknowledgment

The authors wish to express their appreciation to all those who assisted in this work and to the management for permission to publish this article.

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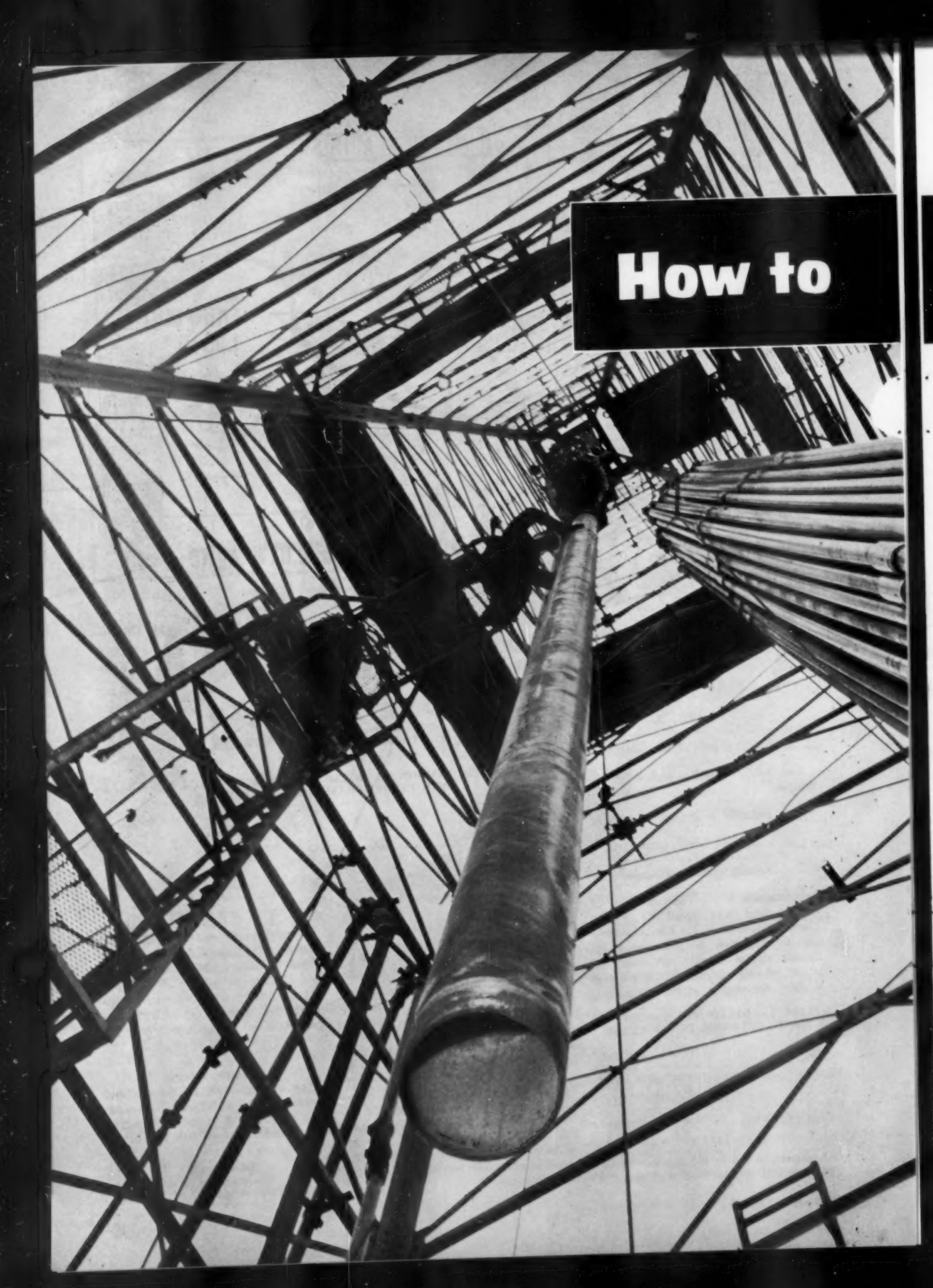
"ASTM Standards on Petroleum Products and Lubricating Oils," 1956, p. 739.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CONSTRUCTION REPORT

Eight new plants

slated for Canada

SHADED PORTION of map is area covered in this survey.

B

● **British American Oil Co., Ltd.,** will complete November 1958, a 20,000-bbl. plant at Port Moody, B. C. **Canadian Kellogg Co., Ltd.,** has contract for a 9,000-bbl. vacuum unit to charge topped crude, a 13,500-bbl. fluid cat cracker (33% recycle), a 4,000-bbl. Atlantic Catformer, a 1,000-bbl. sulfuric acid alkylation unit and a 7,200-bbl. hydrogen treating unit.

At Moose Jaw, Sask., a 5,400-bbl. Atlantic Catformer and a 6,300-bbl. hydrogen treating unit will be added by late 1958, at a cost of $4,000,000. **Lummus Co.** has contract.

● **BP Canada, Ltd.,** will complete a $30,000,000, 25,000-bbl. plant at Ville d'Anjou, Que., by mid-1960. It will include a 15,000-bbl. cat cracker, a 9,000-bbl. cat reformer, a hydrodesulfurization unit, and a polymerization unit. **Lummus Co. of Canada, Ltd.,** has prime contract.

C

● **Canadian Husky Oil, Ltd.,** is considering plans for crude expansion at Lloydminster, Alta.

At Moose Jaw, Sask., crude and cat cracking expansions are being considered.

● **Canadian Oil Companies, Ltd.,** will increase capacity of crude unit 20,000 bbl. and capacity of vacuum unit charging topped crude 10,000 bbl. at Corunna, Ont., by August 1959. **Canadian Kellogg Co., Ltd.,** is contractor.

● **Cities Service Oil Co., Ltd.,** will complete a $26,000,000, 20,000-bbl. plant at Bronte, Ont., southwest of Toronto, December 1958. **C. F. Braun & Co.** has contract for a 7,600-bbl. vacuum unit to charge topped crude, a 13,300-bbl. UOP fluid cat cracker, and a 3,100-bbl. Sinclair-Baker cat reformer.

● **Consumers' Cooperative Refineries, Ltd.,** will complete a 3,000-bbl. UOP delayed coker to produce 145 tons per day of coke (replacing present thermal cracking capacity) at Regina, Sask., by late 1958. **Fluor Corp. of Canada, Ltd.,** is contractor. Cost is $1,300,000.

E

● **Excelsior Refineries, Ltd.,** plans a 4,000-bbl. plant at The Pas, Man., with completion slated for late 1958 or early 1959. Cost will be $1,500,000.

I

● **Imperial Oil, Ltd.,** is increasing crude capacity 14,700 bbl. at Calgary, Alta., as part of a $17,000,000 expansion and modernization program. **Canadian Bechtel, Ltd.,** will complete fall 1959, a 6,600-bbl. fluid cat cracker and a 2,700-bbl. Powerformer.

At Edmonton, Alta., a 1,500-bbl. asphalt plant will be completed spring 1959, at a cost of $1,400,000.

At Regina, Sask., a $3,000,000, 3,000-bbl. Powerformer will be added by late fall 1959. Contract is to be let August 1958.

At Sarnia, Ont., crude capacity will be increased from 78,000 to 94,000 bbl. by mid-1959, by additions to distillation and cracking units. Cost will be $5,360,000.

● **Irving Refining, Ltd.** (Irving Oil Co. and Standard Oil Co. of B. C.), will complete in 1960, a 38,000-bbl. plant at St. Johns, N. B. It will include a two-stage crude unit, a 13,000-bbl. fluid cat cracker (30% recycle), a 7,150-bbl. cat reformer, a 5,000-bbl. hydrodesulfurization unit, and a 2,500-bbl. hydrogen treating unit. Cost will be $45,000,000 to $50,000,000. **Bechtel Corp.** is contractor.

N

● **North Star Oil, Ltd.,** plans to add a $1,100,000, 2,700-bbl. Platformer-Unifiner at St. Boniface, Man., by November 1, 1958. **Procon (Canada), Ltd.,** has contract.

R

● **Royalite Oil Co., Ltd.,** will complete in 1960, a $50,000,000, 20,000-bbl. separation plant to process Athabasca oil sands at Mildred Lake, Alta. **Caribou Engineering Co.** has contract.

S

● **Shell Oil Co. of Canada, Ltd.,** will complete a 20,000-bbl. plant at Bronte, Ont., near Toronto, in 1960.

At North Burnaby, B. C., **Fluor Corp. of Canada, Ltd.,** will complete a distillate hydrodesulfurizer by February 1959. Cost will exceed $2,000,000.

W

● **Wainwright Producers & Refiners, Ltd.,** has let contract to **Ralph M. Parsons Co.** for a 3,000-bbl. thermal cracker and a 1,000-bbl. Platformer at Wainwright, Alta.

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BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Power and cost of gas compression

THE CHART on this page shows the approximate brake horsepower required to compress 1 million cubic feet of gases to pressures as high as 100 times the original pressure using reciprocating compressors. The million cubic feet is measured at 14.4 psia. and at the suction temperature but the chart can also be used with fair accuracy for 1 M.M.c.f. at any reasonably low suction pressure at which the gas is available.

The lower line applies primarily to hydrocarbon gases that have a ratio of specific heats of 1.15 and such gases have a molecular weight of about 36. The upper line applies to diatomic gases such as air, oxygen, hydrogen, carbon monoxide, etc., which have specific heat ratios of about 1.4. Most natural and refinery gases fall at a point intermediate between the two sets of lines.

Single-stage compressors may be used up to compression ratios of 5 or 6, and two-stage compressors up to compression ratios of 20 or 30. In computing the chart, it was assumed that the gas was cooled back to the original temperature after each stage. Although air rises to a much higher temperature than hydrocarbons during compression, it has a lower specific heat. Thus the amount of cooling required to bring the gases back to the original suction temperature (see upper left corner of chart), is much the same for either air or hydrocarbon gases.

Illustration: 2,200,000 cu. ft. of refinery gas is compressed each day from 10 psig. to 180 psig. It is available at 90° F. The compression ratio is:

$$\frac{180 + 14.7}{10 + 14.7} = 7.9$$

This requires two stages of compression and each stage will operate at a compression ratio of about 2.85 (allowing for some pressure drop through the intercoolers). The gas is cooled after the first stage to the original temperature of 90° F.

At 7.9 compression ratio, on the chart, the horsepower required each hour is about 130. The intercooler, using 2.85 compression ratio, must remove about 150,000 B.t.u. per hour, and if an aftercooler is needed, it too must remove the same or a little more heat.

The cost of 130 hp. can be obtained from Processing Costimating No. 22, August 11, 1958, p. 123.

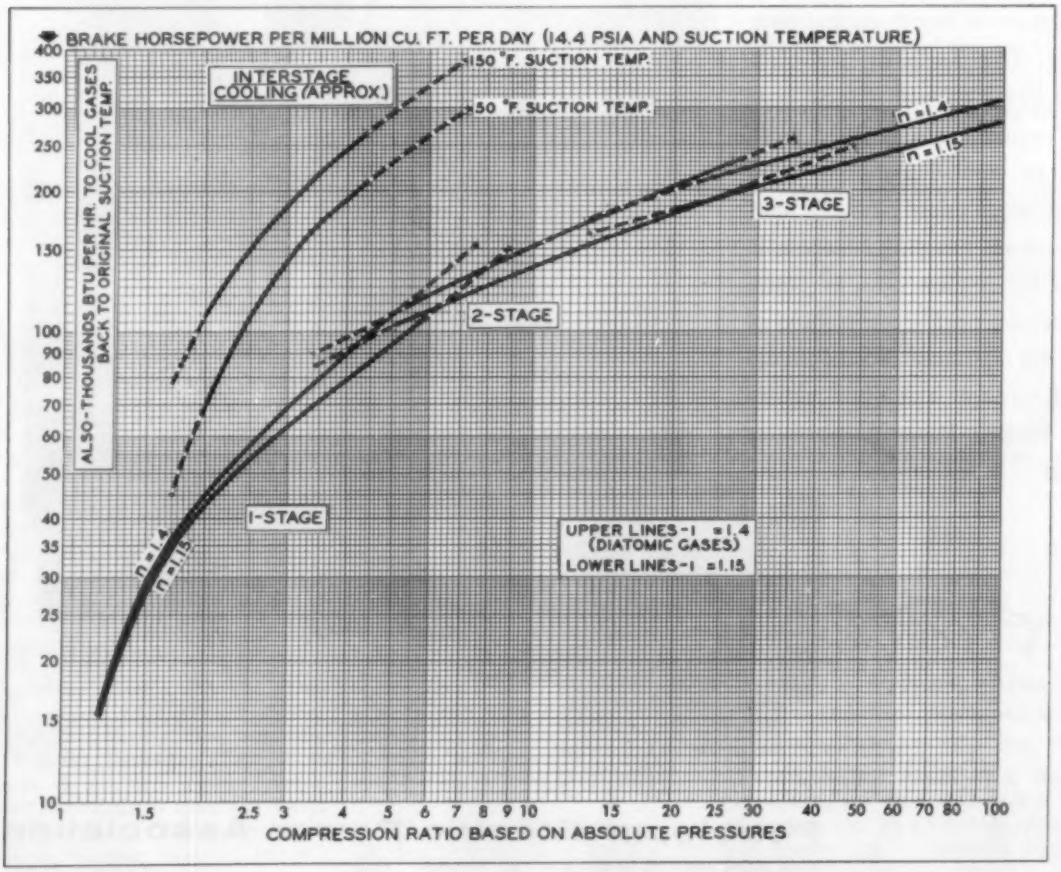

Fig. 1—Approximate power required to compress gases. (Reciprocating type.)

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Carbon-hydrogen ratio of distillate fuels

Will you please give us information on the carbon hydrogen ratio of domestic heating oils, method of test, significance of the data, acceptable limits for satisfactory combustion, and literature references sources covering this subject? D.J.A.

As is so frequently the case, expensive and elaborate tests are made and then no clear relationship to performance is developed

Carbon-hydrogen ratio is one of the many ways (analine point, characterization factor, correlation index, etc.) to generally classify the types of hydrocarbons found in old mixtures. They all fail to describe the chemical composition, first because mixtures can have the same properties as some intermediate chemical compound, and secondly because they measure the average property of the entire mixture rather than the amount of some particular compound or type of compound that may be troublesome. Cauley and Delgass (Carbon Hydrogen Ratio, The Oil and Gas Journal, July 27, 1946, p. 166, and July 19, 1947, p. 83) have made about the most useful study. One of their evaluations (they made nine such) is reproduced in the old or third edition, Petroleum Refinery Engineering (McGraw-Hill Book Co., Inc., third edition, p. 129, 1949).

The determination of C/H ratio is expensive, so correlations of more simple tests have been sought. Cauley and Delgass find that diesel index minus 0.05 times ASTM 50% boiling point correlates closely with C/H ratio. If the above relationship is called (Factor) A —

$$C/H = \frac{28}{3/A + 47}$$

This is probably the best relationship, at least for distillate fuels, but others are found in Table 1 here. A more complete tabulation of factors was published in the December 2, 1957, issue of Questions on Technology, page 118.

The characterization factors of cycle stocks was discussed in the December 14, 1953, issue of Questions on Technology (page 157). Although thermally cracked distillates have characterization factors generally higher than those of catalytic cycle stocks, they are by no means as good from the standpoint of burner deposits.

Scarcely any burning quality tests have been related to the various factors or the C/H ratio. However, Worrall, G. I. (Measuring Burning Quality of Distillate Fuels, Ind. Eng. Chem., 46,2178, Oct. 1954) reports bottom and side deposits on burners. He did not state characterization factor but his results for side deposits seem to be:

	Side deposits, g./2.5 gal.
11.1	100
11.3	60
11.5	36
11.6	25
11.7	16
11.8	10
11.9	7
12.0	4
12.1	2

He described an 11.7-C.F. oil as poor and an 11.85 one as good. Zimmerschied et al, in a somewhat similar test found that the side deposits for a West Texas catalytically desulfurized distillate (probably 11.75-11.8 C.F.) were only 6-9 g., and this was superior to the side deposits for acid treated West Texas distillate or most Mid-Continent kerosines.

The sludges that are produced during storage are, of course, high in C/H ratio (Hawes and Miller, Sludge Formation in Distillate Fuel Oils, Ind. Eng. Chem., 23,1318, Oct. 1941) but this probably has little or nothing to do with the C/H ratio of the parent material.

From all of the above, it seems evident that C/H ratio and other general factors cannot be specifically related to burner performance unless other factors are also defined. Thus, for diesel fuels, the cetane number and diesel index have been found useful rather than C/H ratio, etc.; for kerosines the smoke point is widely used; and in the case of distillate fuels it appears that some other test involving smoke tendency or perhaps storage stability tests may be found to be more directly useful than characterization factor, carbon-hydrogen ratio, etc.

TABLE 1.—APPROXIMATE RELATIONSHIPS OF CARBON-HYDROGEN RATIO TO VARIOUS FACTORS.

UOP charact. factor	Bur. Mines correlation index (493° F.-B.P.)	Smoke point (I.P.) (437° F.-B.P.)	A factor of Cauley and Delgass	Carbon-hydrogen ratio — Cauley and Delgass (500° F. B.P.)	Carbon-hydrogen ratio — Hougen and Watson* (500° F.-B.P.)
12.0	25	25.7	47	6.15	6.18
11.9	28.2	22.6	43	6.23	6.30
11.8	31.7	20.4	39	6.32	6.44
11.7	35.0	18.8	35	6.43	6.59
11.6	38.5	17.5	31	6.55	6.74
11.5	42.0	16.5	26.5	6.68	6.88
11.4	45.5	15.6	22	6.82	7.05
11.3	49.2	14.7	17.5	6.98	7.21
11.2	53.0	14.1	13	7.15	7.40
11.1	57.0	...	8.5	7.34	7.61
11.0	61.0	...	4	7.56	7.82
10.9	65.2	...	0	7.77	...
10.8	69.5	...	—4	8.02	...
10.7	73.7	...	—8.5	8.33	...

*Chemical Process Principles, John Wiley & Sons, Inc., New York, or see p. 170 of W. L. Nelson, Petroleum Refinery Engineering, Third Edition, McGraw-Hill Book Co., Inc., New York, 1949.

Thus, C/H ratio or characterization factor (etc.) can be used to classify (grossly) whether an oil is cracked or not, or whether paraffinic or straightrun materials are present but they cannot distinguish precisely between mixtures and pure materials. Common characterization factors are:

Paraffin base straightrun	12.1
Intermediate straightrun	11.6-12.1
Naphthenic straightrun	10.0-11.5
Catalytic cycle stock, 50% conv. 0. 3-0. 5 below feed	
Catalytic cycle stock, 60% conv. 0.45-0.65 below feed	
Catalytic cycle stock, 70% conv. 0. 6-0. 8 below feed	

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In Three Stage Cementing, two Halliburton "DV" Multiple Stage Cementers are used; the opening and closing seats in the lower cementer are altered by using inserts to make them slightly smaller. Special plugs for passing through both "DV" Cementers and for opening and closing the lower cementer are utilized. A Conversion Kit for Three Stage Cementing, including all necessary plugs and inserts, are furnished with two "DV" Cementers.

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THE OIL AND GAS JOURNAL

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Proper cutoff methods

can save drilling dollars

SO THAT the operator can get the best line performance and the greatest amount of line service per dollar spent, it is very important that he use a regular system of moving the line forward and cutting off at the drum.

Drum-end cuts should be made according to ton-mile records, and the number of feet cut off should be based on drum-core circumference. The cutoff portion should be an even number of wraps plus one-half or one-third.

This procedure changes the load-lifting position on the crown block, traveling-block sheaves, and drum core where the line has had excessive wear. In case of excessive line punishment after pulling on stuck drill pipe, or setting heavy strings of casing, these line positions should be changed more often.

Right Cutting-Off Procedure

The best setup for convenience in making a drum-end cutoff is to hang the block, hook, and elevator on a 1-in. or larger hang line. The upper end of the hang line is attached to the top of derrick and should be long enough to hang down so that its hanging end, when attached to the top of the traveling block, hook, and elevator, and bearing their combined weight, will let the elevator body hang at the correct height for load pickup position when coming out of the hole. Let the drilling line unreel until the combined weight is hanging on the 1-in. hang line and the drilling line will be free of weight.

Taken from LeBus-International Engineers, Inc., wire-line-spooling handbook.

You are then ready to release the drilling line at the dead-line clamp; then start turning the hoist drum and spool the exact amount of additional drilling line onto the drum that is to be cut off. After this amount has slipped through the dead-line clamp and has been spooled onto the drum, then retighten the dead-line clamp.

Then loosen the drilling line at the drum, unwind by hand all the drilling line off the drum, and cut off exactly the predetermined amount in feet and inches. After cutting off, replace and connect the drilling line into the hole of your hoist drum. Start the drum turning to respool your drilling line, and when the weight of the block, hooks, and elevators are picked up, then release your hanging line.

Then let the block, hook, and elevator down through the V-door far enough to unreel all the drilling line off of the drum, after which you begin reeling your drilling line back onto the hoist drum with the combined weight of the block, hook, and elevator. This procedure will tighten your drilling line in the drum grooves and will let you have accurate control over the number of wraps of drilling line on the drum for your load pickup position.

Additional Cutoff Procedure Suggestions

Moving the line forward and making drum cuts as a means of changing the flange turnback, the crossover, and the pickup positions of the line on the sheaves, all of which are points of concentrated rope wear, is commonly recognized as a means of adding useful life to the wire line.

The line position on the dead-line sheave is subject to excessive distortion, and this distorted section of line does not fit the grooves in the operating sheaves properly; and as the line is moved forward to run through these sheaves, that portion is subject to a great deal of excess wear.

A cutoff practice must be avoided which will move the heavily worked section directly onto another sheave with the blocks in pickup position, and to avoid returning to points on the drum of original crossovers on the second or third cut. The amount of line to be discarded should be based on drum-core circumference, and should equal an even number of wraps plus one-half or one-third. The operator should also use a ton-mile calculator and/or a ton-mile chart to determine the number of ton-miles the line has been used in order to determine the amount of wire line in feet that will be discarded on each drum end cut.

Records should be kept at the drilling rig, and the line inspected thoroughly at regular intervals so that each operator can, from his own experience with his individual operating equipment, establish the correct number of feet and inches to be cut off with regularity.

The operator should always take into consideration the running of long strings of casing and tubing, and where the line has had excessive punishment in cases where the drill pipe has been stuck. Check the line often, for bad places sometimes develop before reaching the drum.

	DEPTH OF HOLE										
	0 to 4,000	4,000 to 5,000	5,000 to 6,000	6,000 to 7,000	7,000 to 8,000	8,000 to 9,000	9,000 to 10,000	10,000 to 11,000	11,000 to 12,000	12,000 to 13,000†	Suggested length lines to start
Using 1" line, 3½" Drill Pipe, with approx. 15,000 lbs. excess weight.* Number of trips to make and approx. number of feet to cut off when equal to an even number of wraps plus ½ or ⅓.	Cut off Approx. 25' to 35' ea. 500 T/M or 18 rd. Trips	Ditto 10 rd. Trips	Ditto 8 rd. Trips	Ditto 6 rd. Trips	Ditto 4 rd. Trips	Ditto 3 rd. Trips					1750' to 2500'
Using 1¼" line, 3½" Drill Pipe with approx. 20,000-25,000 lbs. excess weight.* Number of trips to make and approx. number of feet to cut off when equal to an even number of wraps plus ½ or ⅓.	Cut off Approx. 25' to 35' ea. 650 T/M or 20 rd. Trips	Ditto 10 rd. Trips	Ditto 8 rd. Trips	Ditto 6 rd. Trips	Ditto 5 rd. Trips	Ditto 4 rd. Trips	Ditto 3 rd. Trips	Ditto 2 rd. Trips	Ditto 1 rd Trips		2500' to 3500'
Using 1¼" line, 3½" Drill Pipe with approx. 25,000-30,000 lbs. excess weight.* Number of trips to make and approx. number of feet to cut off when equal to an even number of wraps plus ½" or ⅓".	Cut off Approx. 35' ea. 1000 T/M or 18 rd. Trips	Ditto 13 rd. Trips	Ditto 10 rd. Trips	Ditto 8 rd. Trips	Ditto 6 rd. Trips	Ditto 5 rd. Trips	Ditto 4 rd. Trips	Ditto 4 rd. Trips	Ditto 3 rd. Trips	Ditto 2 rd. Trips	3500' to 5000'

* Excess Weight mentioned in this chart refers to the traveling block, hooks and elevators, and where 1 to 20 drill collars are used above the drill bit. Where your excess weight is equally divided between the two weights given, we recommend that you make the applicable number of trips.

† When using 1⅛" line below 13,000 ft. add one coil from reserve every round trip and cut off approximately 60' after 1200 ton mile use.

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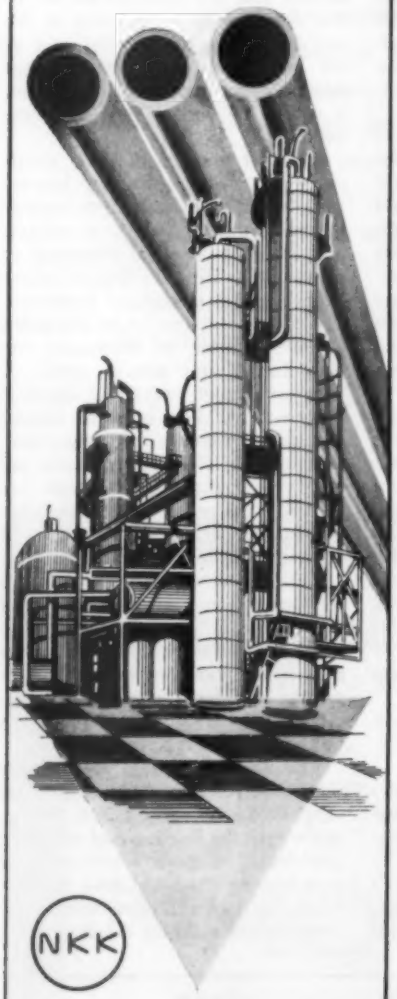
For Oil & Gas Industries



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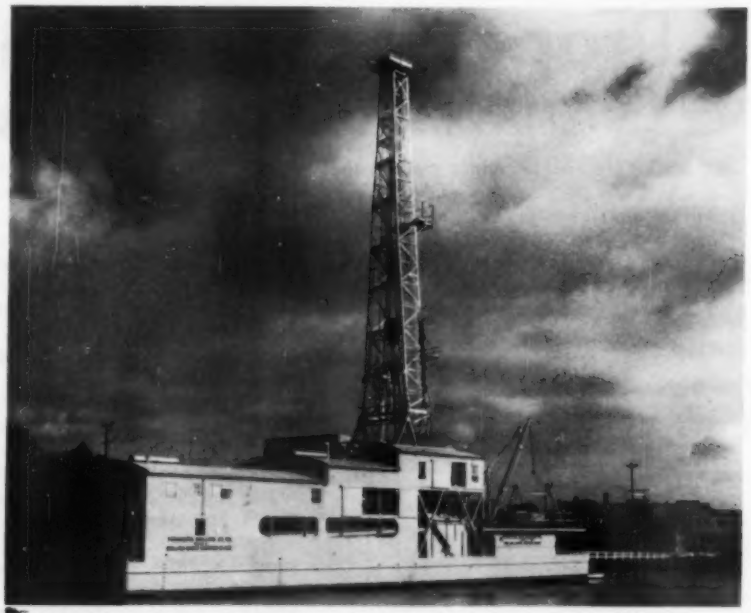
▶ ▶ ▶ Among the Drilling Contractors



NEWLY LAUNCHED drilling barge "Leonard Glade" at Orange, Tex., shipyards ready for work in Louisiana and Texas coastal water beds and marshes.

Another big drilling barge joins Texas-Louisian fleet

ANOTHER large drilling barge has joined the array of modern deep-drilling assemblies available for operation in inshore water bed and marsh areas along the Texas-Louisiana coast.

It is the "Leonard Glade," owned by Producers Drilling Co., of New Orleans, and named for the company's secretary-treasurer.

The new drilling barge, the second for Producers, was launched recently at Levingston Shipbuilding Co.'s yards at Orange, Tex. It is a sister vessel to the "W. F. Youngblood," delivered about a year ago and named for the company's vice president and general manager. J. L. Goldman is president.

The "Leonard Glade," like its predecesser, is a submersible unit with slotted-type hull 185 ft. long, 50 ft. wide, and 14 ft. deep, capable of operating in water depths up to 12 ft. Outfitted by Mid-Continent Supply Co., it was designed to drill to depths of 18,000 ft., or greater.

The drilling assembly uses a Unit Rig U-914-B draw works powered through the compound by three Caterpillar Model D-397 turbo-charged engines. It has two Emsco mud pumps, driven from the compound, and one Gardner-Denver pump, separately powered by a Waukesha engine. On it is a Lee C. Moore 142-ft. cantilever-type mast.

Penrod Moves Offices Shreveport to Dallas

HEADQUARTERS of Penrod Drilling Co., located in Shreveport since February 1949, are being moved to Dallas, effective August 31. New offices are in the Mercantile Securities Building.

The move places the company near its owners, N. B. Hunt, W. H. Hunt, and Lamar Hunt, all of whom live at Dallas.

At Shreveport, the company has employed 35 persons. More than 20 families are making the move.

Penrod operates 30 large rotary rigs, and has been one of the most active contractors in Louisiana, Mississippi, and East and South Texas.

Who's getting the drilling contracts

Hayden Farmer Drilling Co., Olney, Tex., is drilling for W. C. Perryman, of Athens, Tex., and C. L. Norsworthy, of Dallas, at a wildcat loca-

tion 2½ miles northeast of LaRue, in southeastern Henderson County, East Texas. Location, at 1 Abercrombie, in the Simon Boon Survey, is on the east flank of LaRue salt dome. It is a 5,000-ft. Woodbine test.

Oil State Drilling, Inc., Magnolia, Ark., is on a new 4,000-ft. Woodbine test in southeastern Upshur County, East Texas. It is a contract job for George B. Christmas, of Texarkana, at 1 Thurman. Location, in the Richard T. Gibson Survey, is 2 miles northeast of Ashland.

Jack Halbert Drilling Co., Tyler, Tex., is getting started on a 5,800-ft. Woodbine test at a wildcat location 6½ miles southwest of Palestine, in southwestern Anderson County, East Texas. Drilling is for Sam B. King and Clark & Cowdern, of Dallas. Location is on the operators' Collier Estate lease, in the John Adams Survey.

Scooter's Drilling Service, Shreveport, is working on a wildcat location northeast of Tew Lake field, in Catahoula Parish, North Louisiana. La Grange Petroleum Corp. and Petroleum, Inc., of Shreveport, are the operators. Wilcox sand is the objective with expected depth about 4,250 ft.

Big Horn Drilling Co., Casper, is getting well down on a 6,300-ft. Lakota-Morrison test it is drilling for Petroleum, Inc., in the Buffalo Creek area, Crook County, Wyoming. The test is at 1 Butler, in 22-49n-68w.

Noble Drilling Co., Tulsa, is drilling for Shell Oil Co. at a wildcat location north of Edith in northwestern Woods County, northwestern Oklahoma. It is a Mississippian test at 1-14 Robinson, in 14-27n-19w. Nearest production is North Lovedale field, 11 miles northwest, in Harper County. Objective is about 6,200 ft.

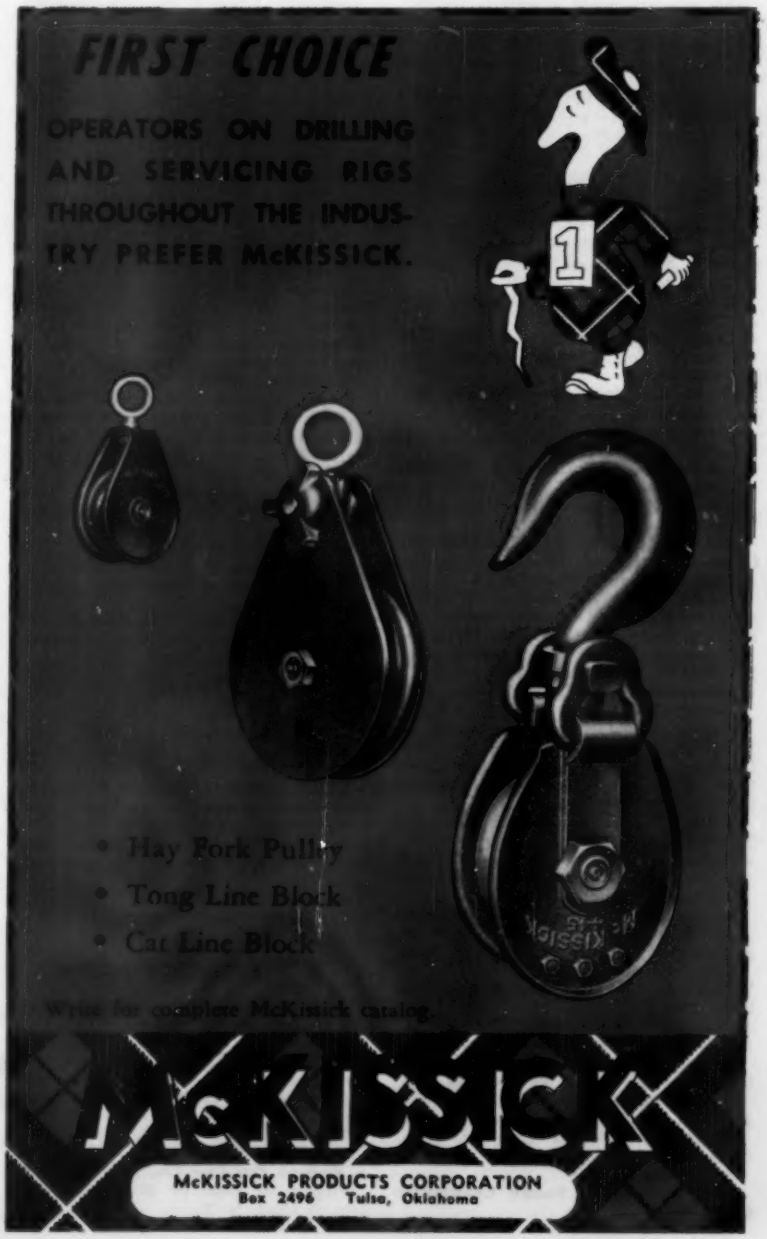
Rocky Mountain Drilling Co., Los Angeles, has a new deep-drilling operation in the Mountain View area, southeast of Bakersfield, in Kern County, California. It is a contract job for Termo Co., whose location at 1 Lamont, in 12-31s-28, is about 3 miles southwest of production. Plans call for drilling to 13,000 ft.

Graham & Klassen, Bakersfield, have the contract on The Texas Co.'s latest well in the Houchin-Guimarra area at Mountain View, southeast of Bakersfield, in Kern County, California. The location, 7 Pauley, is on the north edge of production developed within the past year by Union Oil Co. and Hancock Oil Co. It is 9,000 to 9,500-ft. drilling.

Webster Drilling Co., Tulsa, has a rig working on a distant wildcat location in southeastern Ellis County, in far-western Oklahoma. Drilling is for Poor Boy Oil Co., on its own land in 34-18n-22w. Location is 14 miles southeast of Arnett. A 13,300-ft. test is planned.

John S. Hagestad Drilling Co., Bakersfield, is starting another well for Tidewater Oil Co. in the new Stevens sand pool being developed by the latter company in Buena Vista Hills field, 5 miles northwest of Taft, in Kern County, California. It is Tidewater's fourth well for the pool, productive in the 5,600-5,700-ft. sand opened last November. Location is a west outpost.

Garvey Drilling Co., Great Bend, Kans., is on a new wildcat job in western Morgan County, northeastern Colorado. It is another 6,300-ft. "J" sand test for Petroleum, Inc., at 1 Williams, in 17-4n-59w. Location is about 3 miles southeast of Orchard field.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Monthly Report on PIPELINE CONSTRUCTION

WHO • WHAT • WHERE • WHEN • HOW LONG

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and construction contractors.

This summary report appears in the last issue of the Journal each month. New construction projects are reported weekly in Pipeline Briefs in the Journal's news section.

Projects are listed in three groups—U. S., Canadian, and Foreign—and according to type of line—crude, products, or natural gas.

U. S. Crude Oil Pipelines

• **Bottineau Pipeline Co.** (a N. D. corp.)
Project: An 18-mile line plus gathering system at Newburg field, Bottineau County, N. D.
Status: Has applied to N. D. Public Service Commission for permit.

• **Cape Pipe Line Co.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.), Philadelphia.
Project: Line from lower Delaware Bay to Philadelphia.
Status: Planned.
Completion: 1960.

• **Gillette Pipeline, Inc.,** and **A. W. Hartwig, Inc.**
Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
Status: Pending Wyoming Public Service Commission approval.

• **Great Northern Railway Co.**
Project: 400 to 600 miles of 12 to 20-in. from Williston basin in Montana and N. D., to Clearbrook or St. Paul, Minn.
Contractor: **Pipe Line Technologists, Inc.,** Houston, has completed feasibility study.

• **International Oil Pipeline Corp.,** New York City.
Project: Would own U. S. section of 1,500-mile, 30-in. line proposed by Mid-Continent Pipe Lines, Ltd., from Edmonton, Alta., to Chicago. (See Canadian Crude-Oil Pipelines).
Status: Pending Canadian Board of Transport Commission approval.

• **Jayhawk Pipeline Corp.** (Colorado Oil & Gas Corp., National Cooperative Refinery Association), Wichita, Kans.
Project: 197 miles of 12-in. from Meade to McPherson, Kans., and 42 miles of 10-in. from McPherson to Valley Center, Kans.
Status: Under way.
Contractor: **R. H. Fulton & Co.,** Lubbock, Tex.
Completion: September 1, 1958.

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles of mostly 20-in. dual line in Gulf of Mexico off Louisiana.
Status: Proposed.

• **Service Pipe Line Co.,** Tulsa.
Project: 17 miles of 12-in. from Salt Creek station to Casper, Wyo.
Status: Under way.
Contractor: **O. R. Burden Construction Corp.,** Tulsa.
Completion: September 1, 1958.

• **Shell Oil Co.,** Houston.
Project: 2, 3, and 4-in. flow lines in Mississippi River Delta area.
Status: Under way.
Contractor: **Brown & Root, Inc.,** Houston.
Completion: September 30, 1958.

• **Shell Oil Co., T. & S. Pipe Line Dept., Pacific Coast Div.,** Los Angeles.
Project: 20 miles of 6-in. from Vallecitos in San Benito County to Cheney pump station in Fresno County, California.
Status: Planned.
Completion: September 1, 1958.

• **Shell Pipe Line Corp.,** Houston.
Project: 13 miles of 8-in., 11 miles of 12-in., 31 miles of 16-in., and 65 miles of 20-in. from Mississippi River Delta area to New Orleans refining area.
Status: Work to start October 1958.
Contractor: **Coates Field Service, Inc.,** Oklahoma City, has right-of-way acquisition and claims settlement. **Houston Contracting Co.,** Houston, has the 20-in. to complete December 1958.
Completion: February 1959.
Project: 43 miles of 8-in. main line and 20 miles of 4, 6-in. gathering line to extend facilities from Colorado City, Tex., to the Borden-Garza county area of West Texas.
Status: Under way.
Completion: December 1, 1958.

• **Sinclair Pipe Line Co.,** Independence, Kans.
Project: 140 miles of 8-in. and 140 miles of 12-in. takeup and reconditioning between Teague and Huffman, Tex.
Status: Under way.
Contractor: **Trojan Construction Co.,** Oklahoma City, W. B. Winfrey, spreadman.
Completion: Fall 1958.
Project: 60 miles of 12-in. from Wichita Falls to Jacksboro, Tex.
Status: Under way.
Completion: September 10, 1958.

• **Union Oil Co. of California,** Los Angeles.
Project: 2 miles of 30-in. from proposed outer harbor terminal to Los Angeles outer harbor wharf, and 6 miles of 12-in. crude and bunker fuel line from proposed outer harbor terminal to Union's Los Angeles refinery.
Status: Planned.
Completion: February 1959.

U. S. Products Pipelines

• **Alaska-Yukon Refiners & Distributors, Ltd.,** Edmonton, Alta.
Project: Two lines: one 150 miles from Haines to Haines Junction, Alaska, linking with government Canol line; another from Tok Junction, on Canol line, to Anchorage, Alaska.
Status: Proposed.
Completion: 1959.

• **Buckeye Pipe Line Co.,** New York City.
Project: 55 miles of 10-in. from Syracuse to Utica, N. Y.
Status: Under way.
Contractor: **Sheehan Pipe Line Construction Co.,** Tulsa.
Completion: September 1958.

• **Cherokee Pipe Line Co.** (Continental Oil Co., Cities Service Co.), Bartlesville, Okla.
Project: Conversion of 400 miles of 10-in. crude line between Glenpool, Okla., and Wood River, Ill.
Status: Under way.
Completion: September 1, 1958.

• **Columbia Gas System, Inc.,** New York City.
Project: 37 miles of 6-in. from Kenova, W. Va., to Siloam, Ky.
Status: Planned.
Completion: December 1, 1958.

• **Emerald Pipe Line Corp., Phillips Petroleum Co.,** and **The Texas Co.**
Project: 300 miles of 6-in. from Amarillo, Tex., to Albuquerque, N. M.
Status: Under way.
Contractor: **Arey Pipe & Construction Co., Inc.,** Pampa, Tex., has completed 105 miles from Amarillo to Tucumcari, N. M., and has remainder under way.
Completion: October 1, 1958.

• **Everglades Pipe Line Co.,** Miami, Fla.
Project: 35 miles of 10-in. from Port Everglades, Fla., to Miami's International Airport.
Status: Engineering study under way.
Completion: Late 1958.

• **Katy and New York Central Railroads.**
Project: 2,500 miles of 10-in. and smaller LPG line from Houston through Kansas City, St. Louis, Indianapolis, and Cleveland to Syracuse, then down to New York City. A branch would go through Chicago to Detroit.
Status: Planned. May start before fall 1958.
Contractor: **Williams Brothers Co.,** Tulsa, has completed feasibility study.
Completion: November 1, 1959.

• **Plantation Pipe Line Co.,** Atlanta.
Project: 48 miles of 4-in. to parallel its line from Bremen to LaGrange, Ga.
Status: Under way.
Completion: September 1, 1958.

• **Standard Oil Co. (Ind.),** Chicago.
Project: 23 miles of 8-in. in the Chicago area.
Status: Planned.
Completion: Mid-1959.

• **Texas Eastern Transmission Corp.,** Little Big Inch Div., Shreveport, La.
Project: 10 miles of 8-in. LPG line from Lebanon to Todhunter underground storage in O., and 62 miles of 8-in. from Tyler to Carthage, Tex.
Status: Planned.

• **Underground Storage & Exploration, Inc.,** Upper Darby, Pa.
Project: 393 miles of 12-in. LPG line from Moundsville, W. Va., to Newark, N. J., plus 95 miles of 6, 8-in. laterals to Mauch Chunk, Pa., and to Philadelphia.
Status: Proposed.

• **Union Oil Co. of California,** Los Angeles.
Project: 2 miles of 12-in. bunker fuel line

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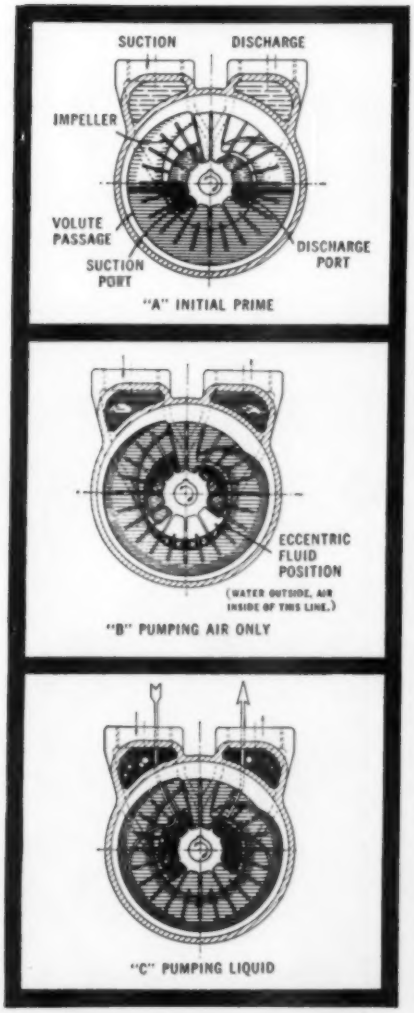

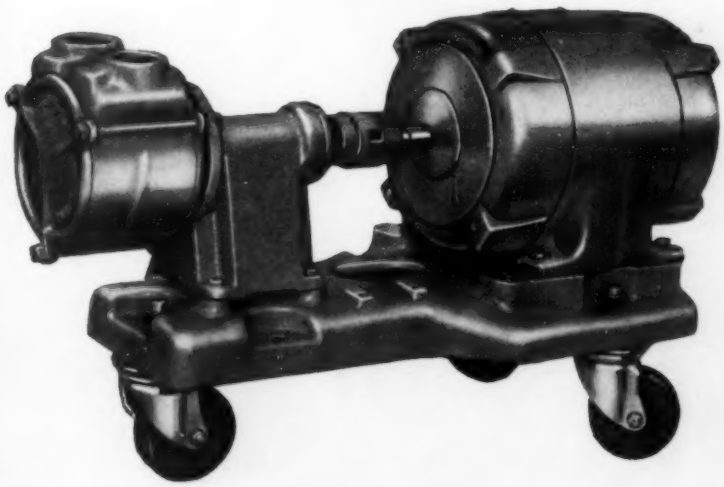

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The Goulds Fig. 2520 pump is available in all-iron construction, or in stainless steel for corrosive service. Offered as a mobile unit (as illustrated), pump-motor unit, or pump only for V-belt drive. With 1½ inch suction and discharge, the pump itself weighs 42 pounds. Capacities to 60 GPM, heads to 80 ft.

There's a complete description of the pump in Bulletin 725.6. Write for a copy or contact your Goulds representative.

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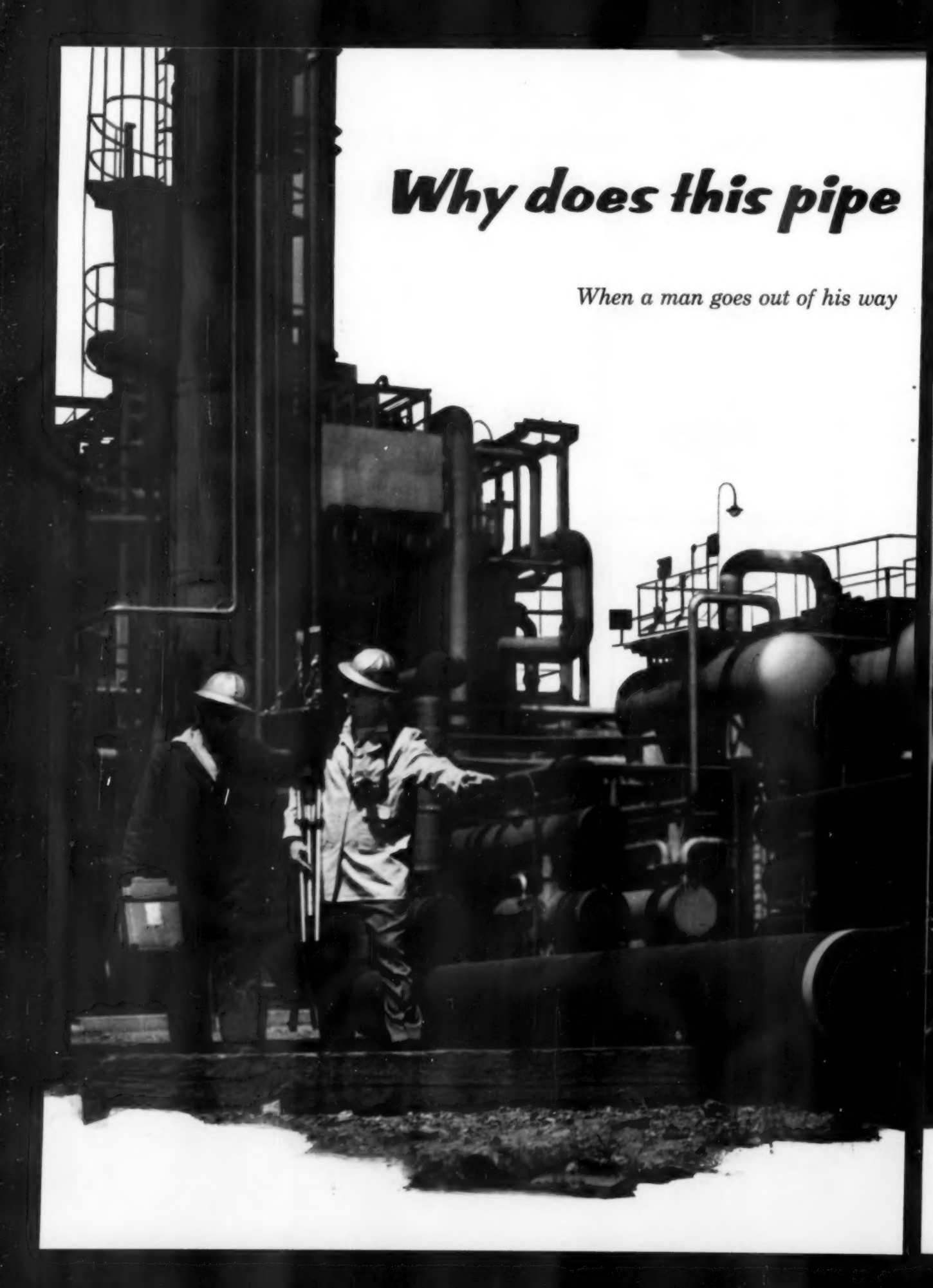

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he likes to brand it. This lets people know the quality they're getting. The orange band marks Youngstown seamless line pipe . . . the finest made. This high-strength, uniform quality seamless pipe is furnished with ends threaded, grooved, or plain end bevelled for welding and for various mechanical couplers. To obtain more information about Youngstown Line Pipe, contact our sales and service offices throughout the oil and gas-producing country. *The Youngstown Sheet and Tube Company, Youngstown 1, Ohio.*

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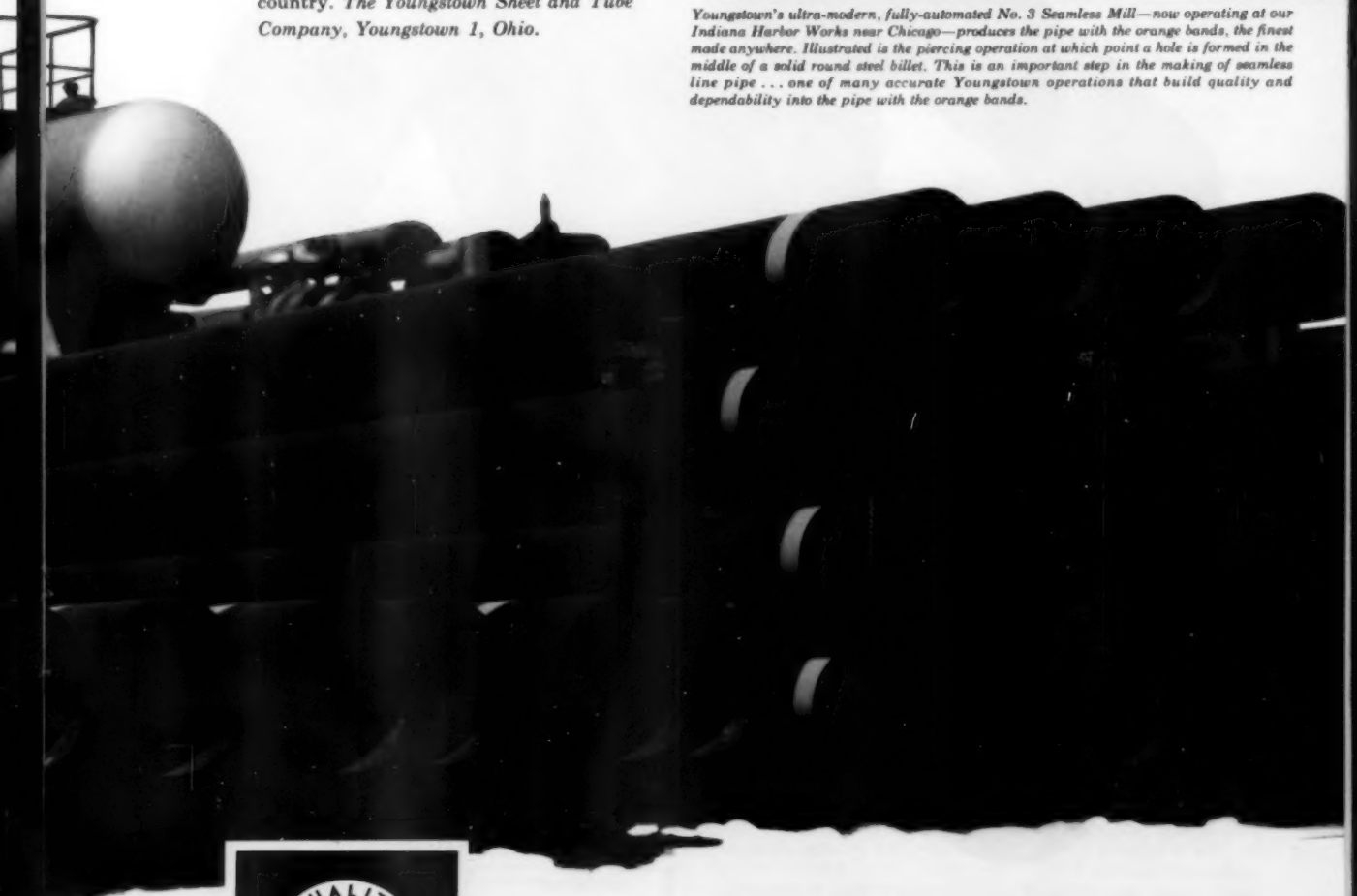

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Suppliers of Valves to:
Royal Dutch Shell Group of Oil Companies • Esso Petroleum Co. Caltex Services • Standard Vacuum Oil Co. • British Petroleum Co. Iranian Oil Services Ltd. • Aramco Overseas Co. • Iraq Petroleum Co. Ltd. • Petrochemicals Ltd. • Mobil Oil Co. Ltd. • Imperial Chemical Industries Ltd. • Distillers Co. Ltd., *and many others.*

Agents throughout the world: Th. J. Van Den Anker VICTORIEPLEIN 17, Amsterdam. Etablissements A. Bruyaux, S.A., 244-246, Rue de la Loi, BRUSSELS, Belgium. Mario D'Orsi, Via Napo Torriani, 1, MILAN, Italy • The Grinnell Company of Canada Ltd., 2440 Dundas Street West, TORONTO 9, Canada • Triangle Valve (Australia) Pty. Ltd., Sussex Street, COBURG N.14, Melbourne, Australia.

from proposed outer harbor wharf to Los Angeles outer harbor wharf, and 6 miles of 12-in. crude and bunker fuel line from proposed outer harbor terminal to Union's Los Angeles refinery.

Status: Planned.

Completion: February 1959.

• **Wabash Pipe Line Co.** (Ohio Oil Co., Continental Oil Co.), Findlay, O.

Project: 265 miles of 12-in. from Hartford, Ill., to Griffith, Ind.

Status: Under way.

Contractor: **Contract & Materials Co.,** Evanston, Ill.

Completion: November 1, 1958.

U. S. Natural-Gas Pipelines

• **American Louisiana Pipe Line Co.,** Detroit.

Project: 28 miles of 12-in. Big Lake, La., gathering lines.

Status: Pending FPC approval.

• **Arkansas Louisiana Gas Co.,** Shreveport, La.

Project: A 300-mile line, plus gathering lines, from Tex.-La. coastal area to northern La., to connect with present system.

Status: Proposed.

Project: A 40-mile line to serve Lake Catherine and Lake Hamilton near Hot Springs, Ark.

Status: Under way.

Completion: December 1958.

• **Atlantic Seaboard Corp.,** Charleston, W. Va.

Project: 12 miles of 26-in. in Hardy County, West Virginia, and 6 miles of 26-in. in Shenandoah County, Virginia.

Status: Has temporary FPC approval.

• **Carnegie Natural Gas Co.,** Pittsburgh.

Project: Two parallel lines between Clairton and Homestead, Pa., to provide coke-oven gas to six Pittsburgh-area plants: 9 miles of 55-in. and 4 miles of 43-in. each.

Status: Under way.

Contractor: **Williams Brothers Co.,** Tulsa.

Completion: January 1, 1959.

• **Central Hudson Gas & Electric Corp.,** Poughkeepsie, N. Y.

Project: 2 miles of 10-in. from T-P Line Tap Point to Danskammer Steam Station and 5 miles of 8-in. from Temple Hill Tap to Newburgh, N. Y.

Completion: November 1958.

• **Chicago District Pipeline Co.,** Chicago.

Project: 52 miles of 30, 36-in. between Joliet and Chicago.

Status: Approved by FPC examiner.

Completion: 1958.

• **Coastal States Gas Producing Co.** and **Southern Coast Corp.,** Corpus Christi, Tex.

Project: 45 miles of 2 to 10-in. in Bee County, Texas, to connect presently shut-in fields with Texas Eastern Transmission Corp.'s system.

Status: Planned.

• **Coastal Transmission Corp.,** Houston.

Project: 94 miles of 12-in. from McAllen to Robstown, Tex.; 147 miles of 20-in. from Robstown to Bay City, Tex.; 68 miles of 22-in. from Bay City to Galveston Bay, Tex.; 252 miles of 24-in. from Galveston Bay to Baton Rouge, La.

Status: Approved. Survey and right-of-way work under way.

Completion: April 1959.

Project: 320 miles of 3 to 14-in. gathering lines at various locations on Texas and Louisiana Gulf Coast.

Status: Approved.

Completion: April 1959.

• **Colorado Interstate Gas Co.,** Colorado Springs, Colo.

Project: 109 miles of 26-in. from Four-Way station in Texas Panhandle, to Morton Junctions in southeastern Colorado; 135 miles of 34-in. from there to Pueblo, and 100 miles of 30-in. on to Denver; 148 miles of 34-in. from CIG line at Rock Springs, Wyo., to Provo, Utah, to connect with proposed El Paso Natural Gas Co.'s line to California.

Status: Planned.

Completion: January 1, 1960.

• **Commonwealth Natural Gas Corp.,** Richmond, Va.

Project: 13 miles of 18-in. from Chester to Petersburg compressor station in Virginia.

Status: Planned.

Completion: September 1, 1958.

• **Consolidated Gas Utilities Corp.,** Oklahoma City.

Project: 21 miles of 12-in. and 10 miles of 8-in. at Altus, Okla.

Status: Under way.

Completion: September 15, 1958.

• **Consumers Power Co.,** Jackson, Mich.

Project: 45 miles of 24-in. from Woodbury station to Laingsburg Junction, Mich.

Status: Planned.

Completion: 1959.

Project: 120 miles of 26-in. from Michigan-Indiana border connection with Trunkline Gas Co., to Plymouth, Mich.

Status: Planned.

Completion: Fall 1959.

• **Eastern Shore Natural Gas Co.**

Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp., in Maryland, across Delaware to Salisbury.

Status: Under way.

Contractor: **Buchanan Pipe Line Construction Co.,** Birmingham, Ala.

Completion: November 1958.

• **El Paso Natural Gas Co.,** El Paso, Tex.

Project: 203 miles of 30-in. Permian-San Juan crossover loops.

Status: Under way.

Contractor: **R. H. Fulton & Co.,** Lubbock, Tex.

Completion: September 1958.

Project: 13 miles of 20-in. and 63 miles of 16-in. Aneth line; 102 miles of field lines.

Status: Approved.

Contractor: **R. H. Fulton & Co.,** Lubbock, Tex., has main line.

Completion: October 1958.

Project: 177 miles of 20-in. from Sonora plant, Sutton County, to Plains plant, Yoakum County, Texas.

Status: Under way.

Contractor: **R. H. Fulton & Co.,** Lubbock, Tex., and **McVean & Barlow, Inc.,** Odessa, Tex.

Completion: October 1958.

Project: 74 miles of 10-in. Yuma line loop.

Status: Has temporary FPC approval.

Completion: September 1958.

Project: 400 miles of 34-in. from Salt Lake City, to California border near Las Vegas, Nev.

Status: Planned.

Completion: September 1, 1959.

Project: 1,000 miles of main line loop from Plains, Tex., to California border.

Status: Planned.

Completion: 1960.

• **Gulf Interstate Gas Co.,** Houston.

Project: 10 miles of 12-in. supply loop to Erath field, Vermilion Parish, Louisiana, and 9 miles of various-size field lines in Acadia and Vermilion parishes, Louisiana.

Status: Approved.

Project: 10 miles of 20-in. loop in Jefferson Davis and Vermilion parishes, Louisiana, and 3 miles of 6-in. loop in Cameron Parish.

Status: Has temporary FPC approval.

Project: 352 miles of 30-in. loop between Louisiana and Leach, Ky.; 54 miles of 24-in. lateral in Louisiana.

Status: Under way.

Contractor: **Houston Contracting Co.,** Houston, has 216 miles of 30-in.: 110 miles beginning near Inverness, Miss., A. J. Slovack, superintendent, office at Greenwood, Miss.; 106 miles beginning near Jena, La., L. A. Young, superintendent, office at Jena. Houston also has the 24-in. **H. C. Price Co.,** Bartlesville, Okla., has 132 miles in Kentucky and Tennessee, R. L. Ezell, superintendent, office at Stanford, Ky., and C. R. Ice, superintendent, office at Tompkinsville, Ky.

Completion: November 1, 1958.

• **Gulf Resources, Inc.,** Dallas.

Project: 125-mile line from Lopeno field in Zapata County to a point in LaSalle County, Texas.

Status: Proposed.

• **Houston Texas Gas & Oil Corp.,** St. Petersburg, Fla.

Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 139 miles of 18-in. and 101 miles of 20-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line will join Coastal Transmission's line from McAllen, Tex., to Baton Rouge, La.

Status: Right-of-way procurement under way.

Contractor: **Midwestern Constructors, Inc.,** Tulsa, has the 702 miles of 24-in. **Harbert Construction Corp.,** Birmingham, has remainder.

Completion: 1959.

• **Humble Oil & Refining Co.,** Houston.

Project: 250 miles of 26 or 30-in. from Southwest Texas to Houston.

Status: Planned.

Completion: 1960.

Project: 67 miles of 30-in. between Clear Lake and Lovell Lake Junction, Tex., and 24-in. from there to Port Arthur, Tex.

Status: Under way.

Contractor: **Sharman, Allen, Gay & Taylor,** Houston, has completed 39 miles from Hankamer to Port Arthur. **Panama-Williams Corp.,** Houston, has 39 miles from Clear Lake to Hankamer. **Gulf Welding & Machine Works,** Conroe, Tex., has the Houston Ship Channel crossing.

Completion: Fall 1958.

Project: 37 miles of 24-in. and 47 miles of 12-in. gathering lines in Falfurrias area of Southwest Texas.

Status: Under way.

Contractor: **H. B. Zachry Co.,** San Antonio, Tex., has the 24-in. **H. S. Shanks & Sons,** Alice, Tex., has the 12-in.

Completion: Fall 1958.

• **Iron Ranges Natural Gas Co.,** St. Paul.

Project: 70 miles of 6 to 16-in. in Mesabi Iron Range area.

Status: Pending FPC approval.

Completion: 1959.

Project: 63 miles of 12-in. between Duluth and Silver Bay, Minn.

Status: Pending FPC approval.

Completion: 1959.

• **Kansas-Nebraska Natural Gas Co., Inc.,** Hastings, Neb.

Project: 23 miles of 6-in. from Atwood to Akron, Colo.

Status: Planned.

Contractor: **Brodie Construction Co.,** Amarillo, Tex.

Completion: December 1, 1958.

Project: 11 miles of 4, 6-in. in Denver-Julesburg basin; 8 miles of 4, 6-in. gathering lines in Texas County, Oklahoma; 5 miles of 4, 6-in. gathering lines in Hugoton field, Kansas; 3 miles of 4, 6-in. gathering lines in Unruh field, Kansas.

Status: Under way.

Contractor: **Nichols Construction Co.,** Great Bend, Kans., has Unruh field project. **Brodie Construction Co.,** Amarillo, Tex., has remainder.

Completion: October 1, 1958.

PIPELINE CONSTRUCTION

• **Lone Star Gas Co.,** Dallas.
Project: 14 miles of 12-in. in Taylor County, Texas.
Status: Planned.
Contractor: Company forces.
Completion: September 1958.

• **Magnolia Petroleum Co.,** Dallas.
Project: 22 miles of 16-in. offshore, Louisiana.
Status: Under way.
Contractor: **Brown & Root, Inc.,** Houston.
Completion: Fall 1958.

• **Manufacturers Light & Heat Co.,** Pittsburgh.
Project: 5 miles of 12-in. from Empire to Toronto, Ohio.
Status: Will file for FPC approval.
Completion: September 1958.
Project: 9 miles of 8-in. from Steubenville to Wintersville, Ohio.
Status: Planned.
Completion: December 1958.
Project: 9 miles of 8-in. from Berlin to Somerset, Pa.
Status: Planned.
Completion: January 1959.
Project: 34 miles of 20-in. in Greene, Adams, and York counties, Pennsylvania.
Status: Has temporary FPC approval.
Completion: Before end 1958.

• **Michigan Consolidated Gas Co.,** Detroit.
Project: 67 miles of 10, 12-in. between Sears and Traverse City, Mich.
Status: Under way.
Contractor: **Somerville Construction,** Ada, Mich., Floyd Huduall, superintendent, office at Cadillac, Mich.
Project: 60 miles of 10, 12-in. between Muskegon and Ludington, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.,** Ada, Mich., jointly with **H. L. Gentry Construction Co.,** Jackson, Mich., Frank Morris, superintendent, office at Hart, Mich.

• **Michigan Wisconsin Pipe Line Co.,** Detroit.
Project: 20 miles of 4, 13 miles of 6-in., 2 miles of 12-in., 4 miles of 10-in., and 7 miles of 8-in. gathering lines in Laverne field, Harper County, Oklahoma.
Status: Approved.
Completion: October 1, 1958.
Project: 56 miles of 20-in. extension into Kansas of Laverne line, Harper County, Oklahoma.
Status: Approved.
Completion: October 1, 1958.
Project: 25 miles of 12-in. and 21 miles of 24-in. looping of Madison, Wis., lateral.
Status: Approved.
Completion: October 1, 1958.

• **Mississippi River Fuel Corp.,** St. Louis.
Project: 38 miles of 26-in. loop between Bald Knob, Ark., and Perryville, La.
Status: Pending FPC approval.
Completion: December 1958.

• **Montana-Dakota Utilities Co.,** Minneapolis.
Project: 12 miles of 12-in. paralleling main line between Billings and Laurel, Mont.
Status: Under way.
Contractor: **Albrecht Construction Co.,** Bridger, Mont.
Completion: August 31, 1958.

• **Natural Gas Pipeline Co. of America,** Chicago.
Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 36-in. between Beatrice and Joliet, Ill., along existing system.
Status: Pending FPC approval.
Project: 232 miles of 36-in. between Beatrice, Neb., and Joliet, Ill., and 258 miles of 36-in. and 21 miles of 26-in. between Texas Panhandle and Beatrice.
Status: Has temporary FPC approval. Under way.
Contractor: **R. H. Fulton & Co.,** Lubbock, Tex., has 21 miles of 26-in. and 102 miles of 36-in. between Fritch and Kans. line, and 105 miles of 36-in. in Kans. **Williams Brothers Co.,** Tulsa, has 106 miles of 36-in. in Kans. and Neb., terminating near Emerson, Iowa, and 99 miles of 36-in. from there to Harper, Iowa. **Contracting Materials Co.,** Chicago, has 82 miles of 36-in. from Harper, Iowa, to Joliet, Ill.
Project: 84 miles of gathering line in Jack and Wise counties, Texas.
Status: Under way.
Contractor: **O. R. Burden Construction Corp.,** Tulsa.
Completion: September 1958.

• **New York State Natural Gas Corp.,** Pittsburgh.
Project: 30 miles of 20-in. from Castile to Elma, N. Y.
Status: Pending FPC approval.
Contractor: **Joyce Pipe Line Co.,** Andover, N. Y.
Completion: October 10, 1958.
Project: 4 miles of 6-in., 2 miles of 8-in., 1 mile of 10-in., and 13 miles of 12-in., storage lines in Leidy and Stewardson townships, Pennsylvania.
Status: Pending FPC approval.
Contractor: **Harford Brothers,** Emporium, Pa.
Completion: November 1, 1958.

• **North Carolina Natural Gas Corp.,** Fayetteville, N. C.
Project: 730 miles of 2 to 16-in. from near Mooresville, eastwardly across North Carolina.
Status: Under way.
Completion: Late 1958.

• **Northern Illinois Gas Co.**
Project: 140 miles of 24-in. from Des Plaines to East Dubuque, Ill.
Status: Pending FPC approval.
Contractor: **Williams Brothers Co.,** Tulsa, has preliminary engineering and right-of-way studies under way.
Completion: November 1, 1958.

• **Northern Natural Gas Co.,** Omaha, Neb.
Project: 18 miles of 20-in. from Dubuque, Iowa, to Menominee, Ill.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 19 miles of 30-in. from S. Sioux City to Oakland, Neb.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 9 miles of 30-in. from Palmyra to Beatrice, Neb.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 11 miles of 30-in. from Clifton to Tescott, Kans.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 8 miles of 30-in. from Tescott to Bushton, Kans.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 11 miles of 30-in. from Sunray, Tex., to Beaver, Okla.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 8 miles of 30-in. and 44 miles of 16-in. from Beaver, Okla., to Mullinville, Kans.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 169 miles of 20-in. from Farmington, Minn., to Superior, Wis.
Status: Pending FPC approval.
Project: 23 miles of 24-in. main line loop in Nebraska.
Status: Pending FPC approval.
Project: 43 miles of 20-in. main line loop in Kansas, Nebraska, and Louisiana.
Status: Pending FPC approval.
Project: 44 miles of 16-in. in Duluth-Superior, Wis., area.
Status: Pending FPC approval.
Project: 1,100 miles of 26-in. from Montana border to Minneapolis. (See Northern Natural Gas Co. in Canadian Natural Gas Pipeline section.)
Status: Planned.
Project: 1,090 miles of 2 to 16-in. branch lines in Minnesota, Louisiana, South Dakota, Nebraska, and Wisconsin.
Status: Pending FPC approval.
Project: 57 miles of 30-in. main line loop in Nebraska and Kansas.
Status: Pending FPC approval.

• **Northern Utilities Co.,** Casper, Wyo.
Project: 35 miles of 16-in. in Fremont-Natrona counties, Wyoming; 8 miles of 12-in. near Casper, Wyo.; 6 miles of 8-in. from Sand Draw gas field to Beaver Creek field, Wyoming; 12 miles of 6-in. from Beaver Creek field to the system servicing the Riverton-Lander, Wyo., area.
Status: Planned.

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in., 70 miles of 26-in., and 234 miles of 30-in. dual line.
Status: Pending FPC approval.

• **Ohio Fuel Gas Co.,** Columbus.
Project: 15 miles of 12-in. from Line H, Crawford Station to Zanesville, Ohio.
Status: Approved.
Completion: September 1, 1958.
Project: 3 miles of 20-in. from Line D-357 to near Marion, Ohio.
Status: Approved.
Completion: August 30, 1958.
Project: 2 miles of 12-in. from Line Z to near Troy, Ohio.
Status: Approved.
Completion: September 15, 1958.
Project: 10 miles of 8-in. from Line O-1463 to near St. Clairsville, Ohio.
Status: Approved.
Completion: October 5, 1958.
Project: 4 miles of 20-in. from Line A-97 to near Dayton.
Status: Approved.
Completion: October 2, 1958.

• **Oklahoma Missouri Gas Transmission Co.,** Oklahoma City.
Project: 500 miles of 24-in. from Central Oklahoma to St. Louis.
Status: Proposed.

• **Pacific Lighting Gas Supply Co.,** Los Angeles.
Project: 128 miles of 34-in. from Topock to Newberry, Calif.
Status: Filed April 1958 for California Public Utilities Commission approval.
Completion: November 1, 1958.

• **Pacific Northwest Pipeline Corp.,** Salt Lake City.
Project: 40-mile line from Ute Trail fields in northeastern Utah, to its main line in western Colorado.
Status: Under way.
Project: 51 miles of 30-in. from main line to Big Piney field, Wyoming, looping present 16-in. lateral.
Status: Has temporary FPC approval.

• **Panhandle Eastern Pipe Line Co.,** Kansas City, Mo.
Project: 68 miles of 4-in., 37 miles of 6-in., 35 miles of 8-in., and 12 miles of 12-in. gathering lines in Kansas, Oklahoma, and Texas.
Status: Under way.
Contractor: **B. C. Hall Constructors, Inc.,** Aztec, N. M.
Completion: December 31, 1958.
Project: 33 miles of 16-in. from Muncie, Ind., to Hollansburg, Ohio.
Status: Under way.
Contractor: **O. R. Burden Construction Corp.,** Tulsa.
Completion: September 1, 1958.

• **Pennsylvania Gas Co.,** Warren, Pa.
Project: 23 miles of 10-in. in Erie County, Pennsylvania, 15 miles of 8-in. in Warren and Chautauqua counties, Pennsylvania, 30

PIPELINE CONSTRUCTION

miles of branch lines, and several small distribution lines.

Status: Approved.

• **Peoples Natural Gas Co.,** Pittsburgh.

Project: 17 miles of 24-in. from McKeesport, Pa., southward.

Status: Planned.

Completion: September 1958.

• **Piedmont Gas Co.,** Hickory, N. C.

Project: 78 miles of 2 to 8-in. extension off Transcontinental in North Carolina, to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.

Status: Approved.

• **Pioneer Gathering System, Inc.,** Amarillo, Tex.

Project: Gathering lines in Texas fields: 7 miles of 4-in. in Buckhorn field; 2 miles of 6-in., 1 mile of 4-in., and 2 miles of 8-in. in Vinegarone field; 2 miles of 3-in. in Mount Ketchum field; 4 miles of 3-in., 1 mile of 2-in., and 16 miles of 4-in. in Tilleny field; 7 miles of 2-in. in Mertyon field.

Status: Pending FPC approval.

Completion: November 1, 1958.

• **Signal Oil & Gas Co.,** Los Angeles.

Project: Considering expansion of gathering system for its sulfur-extraction plant at Tioga, N. D., into the developing oil area near the Canadian border in Burke County.

• **Southern California Gas Co.,** Los Angeles.

Project: 3 miles of 20-in. Kettleman-Lemoore system in Kings County, California.

Status: Planned.

Completion: October 1958.

Project: 186 miles of 34-in. from Ivanpah Lake to Placentia, Calif.

Status: Proposed.

• **Southern California Gas Co.,** and **Southern Counties Gas Co. of California,** Los Angeles.

Project: 19 miles of 30-in. from near Newhall, Calif., to Burbank Boulevard and Yarmouth Avenue in Los Angeles.

Status: Under way.

Contractor: **Engineers Limited Pipeline Co.,** San Francisco.

Completion: November 1, 1958.

• **Southern Counties Gas Co. of California,** Los Angeles.

Project: 20 miles of 24-in. from Temecula, Calif., northward.

Status: Planned.

Completion: November 1, 1958.

• **Southern Natural Gas Co.,** Birmingham, Ala.

Note: Parts of several projects below have been contracted. **Williams Brothers Co.,** Tulsa, has 42 miles of 24-in. from Lake Pontchartrain to Franklinton, La. **River Construction Corp.,** Fort Worth, has 67 miles of 26-in. and 57 miles of 24-in. between Gwinville and Enterprise, Miss. **Houston Contracting Co.,** Houston, **H. C. Price Co.,** Bartlesville, and **Latex Construction of Georgia,** Atlanta, have 166 miles of 24-in., and 47 miles of 20-in. on South Line, and 63 miles of 14-in. loop on Atlanta and Rome, Ga., lines. **Ford, Bacon & Davis, Inc.,** New York City, has 18 miles of 8-in. on LaGrange, Ga., and Calera, Ala., lines, 5 miles of 12-in. at Amory, Miss., 8 miles of 20-in. between Gwinville nd Pickens, Miss., and 12 miles of 6-in. on Vicksburg line. **Western Pipeline, Inc.,** Austin, Tex., has 29 miles of 24-in. main line loop, 46 miles of 20-in., 14 miles of 16-in., 14 miles of 10-in., 23 miles of 8-in., and 7 miles of 6-in. **Brown & Root, Inc.,** Houston, has 16 miles of 20-in., 14 miles of 16-in., 25 miles of 12-in., 2 miles of 8-in., 12 miles of 6-in., and 6 miles of 4-in.

Project: Supply lines in South Louisiana: 9 miles of 16-in. Bayou Long field lateral; 7 miles of 16-in. Little Bayou Pigeon lateral; 4 miles of 6-in. Mystic Bayou field lateral; 2 miles of 6-in. East Bayou Pigeon lateral.

Project: 7 miles of 24-in. from Gwinville to Pickens, Miss.

Project: 13 miles of 10-in. Tantine field lateral in South Louisiana.

Project: 3 miles of 8-in. Dexter field lateral in Mississippi.

Project: Supply lines in South Louisiana: 46 miles of 20-in. from White Castle to South Section 28 field; 7 miles of 10-in. Bayou Boullion field lateral; 11 miles of 8-in. East Happytown field lateral; 8 miles of 10-in. and 11 miles of 8-in. Loisel field lateral; 17 miles of 20-in. Lake Washington field lateral; 22 miles of 12-in. West Delta Block 30 lateral; 4 miles of 8-in. Bayou Long field lateral; 6 miles of 4-in. Bayou Villars field lateral; 12 miles of 6-in. Marrero field lateral; 6 miles of 6-in. South Lake Long field lateral; 1 mile of 4-in. Tigers Ridge field lateral; 35 miles of 16-in. Montegut field lateral; 13 miles of 16-in. Barataria Line loop; 69 miles of 24-in. from Toca to Franklinton.

Status: Above five projects approved and under way.

Completion: 1958-1959.

Project: 67 miles of 24-in. from Gwinville to Enterprise, Miss.; 71 miles of 24-in. from Enterprise to Gallion, Ala.; 83 miles of 24-in. from Gallion to Elmore, Ala.; 43 miles of 20-in. and 46 miles of 24-in. from Elmore to Ellerslie, Ga.; 69 miles of 20-in. from Ellerslie to Ocmulgee, Ga.; 79 miles of 16-in. from Ocmulgee to Wrens, Ga.; 8 miles of 6-in. Vicksburg, Miss., loop; 5 miles of 12-in. Amory, Miss., loop; 9 miles of 8-in. Calera, Ala., loop; 23 miles of 14-in. Rome, Ga., loop; 9 miles of 8-in. at LaGrange, Ga.; 62 miles of 14-in. from Ocmulgee, Ga., to Atlanta.

Status: Pending FPC approval.

Project: Facilities to attach additional supplies in South Louisiana; 6 miles of 8-in. from Ship Shoals Block 28 to Block 32; 29 miles of 16-in. from Ship Shoals Block 28 to Atchafalaya Bay; 15 miles of 16-in. from north shore Atchafalaya Bay to Patterson; 6 miles of 16-in. from Patterson to Duck Late; 8 miles of 6-in. Bayou Felice lateral; 1 mile of 4-in. Triumph field lateral; 2 miles of 8-in. Coffee Bay field lateral.

Status: Pending FPC approval.

Completion: 1958-1959.

Project: Facilities to attach additional supplies in Mississippi: 8 miles of 8-in. Hub field lateral; 40 miles of 14-in. and 40 miles of 16-in. from Cranfield to Gwinville.

Status: Pending FPC approval.

Completion: 1958-1959.

Project: 2 miles of 4-in. Bayou Postillion lateral.

Status: Pending FPC approval.

• **Tennessee Gas Transmission Co.,** Houston.

Project: 556 miles of 30-in. from Mississippi Delta area south of New Orleans to Portland, Tenn.; 163 miles of 30-in. and 101 miles of 26-in. from Portland to near Lancaster, Ky., from Winchester, Ky., to Morehead, Ky., from Catlettsburg, Ky., toward Broad Run, W. Va., from New Wilmington, Pa., to Mercer, Pa., and from Morehead to Catlettsburg.

Status: Approved. Under way.

Contractor: **Oklahoma Contracting Co.,** Dallas, has 90 miles from Columbia, Miss., to the Tennessee River, Ed Peters, superintendent. **Sharman, Allen, Gay & Taylor,** Houston, has 28 miles in St. Bernard Parish, Louisiana, and Hancock County, Mississippi. **Houston Contracting Co.,** Houston, has 37 miles in Plaquemines and St. Bernard parishes, Louisiana, R. E. Thronton and R. L. Silar, superintendents. **Bechtel Corp.,** San Francisco, **Grayco Constructors, Inc.,** Austin, Tex., **Western Pipe Line, Inc.,** Austin, Tex., and **Panama, Inc.,** Houston, have remainder.

Project: 21 miles of 16-in. and 2 miles of 12-in. to offshore Louisiana fields.

Status: Pending FPC approval.

Project: 76 miles of 24-in. from Coudersport, Pa., to Hamburg, N. Y.

Status: Approved.

Contractor: **Williams Brothers Co.,** Tulsa.

• **Tensas Gas Gathering Corp.**

Project: 37 miles of 2 to 8-in. from Rodney field, Mississippi, westerly to connect with Olin Gas Transmission Co.'s line in Tensas Parish, Louisiana.

Status: Approved.

• **Texas Eastern Penn-Jersey Transmission Corp.**

Project: 12 miles of 30-in. looping in Pennsylvania.

Status: Approved.

Contractor: **H. C. Price Co.,** Bartlesville, Okla.

• **Texas Eastern Transmission Corp.,** Shreveport, La.

Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.

Status: Approved.

Project: 22 miles of 14-in. from Rayne field to near Opelousas, La.

Status: Approved by FPC examiner.

Completion: November 1958.

Project: 47 miles of 30-in. looping in Kentucky and Ohio.

Status: Under way.

Contractor: **H. C. Price Co.,** Bartlesville, Okla., G. A. Reutzel, superintendent, office at Caldwell, Ohio; W. H. Olrich, superintendent, office at Danville, Ky., to later move to Portsmouth, Ohio.

• **Texas Gas Transmission Corp.,** Owensboro, Ky.

Project: 92 miles of 30-in. looping near Alexandria and Bastrop, La., and near Greenville and Clarksdale, Miss.

Status: Pending FPC approval.

Project: 13 miles of 16-in. looping in Jefferson Davis and Acadia parishes, Louisiana.

Status: Pending FPC approval. Hearing set for July 29, 1958.

Project: 19 miles of 26-in. looping near Hardinsburg and West Point, Ky.

Status: Pending FPC approval.

Project: 15 miles of 16-in. and smaller looping near Henderson, Ky., Petersburg and Linton, Ind., and Lawrenceville, Ill.

Status: Pending FPC approval.

• **Texas Illinois Natural Gas Pipeline Co.,** Chicago.

Project: 860 miles of 30-in. looping of present system.

Status: Planned.

Completion: 1960-1961.

• **Transcontinental Gas Pipe Line Corp.,** Houston.

Project: 107 miles of 30-in., and 205 miles of 36-in. main line looping in various states.

Status: Approved by FPC examiner.

Contractor: **Bechtel Corp.** has 55 miles of 36-in. and 8 miles of 30-in. in New Jersey and Pennsylvania.

Completion: Last half 1958.

Project: 1 mile of 30-in. and 51 miles of 36-in. main line loops in various states.

Status: Approved by FPC examiner.

Completion: 1959.

Project: 445 miles of 24-in. and smaller purchase laterals in Texas and Louisiana.

Status: Approved by FPC examiner.

Completion: Last half 1958.

Project: 29 miles of 30-in. and 164 miles of 23-in. from Leidy storage field in Pennsylvania, to its trunk line to New York.

Status: Approved by FPC examiner.

Contractors: **Sharman, Allen, Gay & Taylor,** Houston, has 65 miles. **Panama-Williams Corp.,** Houston, has remainder.

PIPELINE CONSTRUCTION

Completion: Last half 1958.
Project: 52 miles of 10, 14-in. purchase laterals in Texas and Louisiana.
Status: Approved by FPC examiner.
Completion: 1959..

• **Transwestern Pipe Line Co.** (Warren Petroleum, Monterey Oil Co., J. R. Butler), Dallas.
Project: 635 miles of 24-in. from Perryton and Fort Stockton, Tex., to Roswell, N. M., and 670 miles of 30-in. from Roswell to Topock, Ariz.
Status: Pending FPC approval.
Completion: Mid-1959.

• **Trunkline Gas Co.,** Houston.
Project: 464 miles of 30-in. looping between Longville, La., and Tuscola, Ill.; 44 miles of 24-in. looping in Texas; and 204 miles of 26-in. extension of main line from Tuscola to Vistula, Ind., to connect with Consumers Power Co.
Status: Pending FPC approval.
Completion: Fall 1959.
Project: 24, 26-in. Red River crossing in Rapides Parish, Louisiana.
Status: Under way.
Contractor: **Missouri Valley Dredging Co.,** Omaha.
Completion: January 1959.
Project: 143 miles of 12 to 20-in. and 40 miles of 4 to 10-in. purchase laterals.
Status: Planned.

• **United Gas Pipe Line Co.,** Shreveport, La.
Project: 117 miles of 30-in. looping from Southeast Louisiana, to Mobile, Ala.
Status: Approved. To start September 1958.
Project: 15 miles of 12-in. from N. Henderson field to Carthage-Longview main line.
Status: Planned.
Completion: End of 1958.
Project: 9 miles of 16-in. from Belle Isle field offshore Louisiana, to Kosciusko main line.
Status: Planned.
Completion: End of 1958.
Project: 10 miles of 20-in. from South San Antonio loop to Burnell converse main line.
Status: Planned.
Completion: October 1, 1958.

Canadian Crude-Oil Pipelines

• **Act Oils, Ltd.**
Project: A 450-mile line from the Peace River region of northern British Columbia to tidewater at Kitimat, B. C.
Status: Pending British Columbia Government approval.

• **B-A Alberta Pipe Line, Ltd.,** Calgary, Alta.
Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

• **Bituminous Oil Pipeline Co.** (Royalite Oil Co., and Can-Amera Oilsands Development, Ltd.)
Project: A 250-mile line from Athabasca oil sands in northeastern Alberta, to Edmonton.
Status: Proposed.
Completion: 1960.

• **Federated Pipe Lines, Ltd.** (subsidiary of Home Oil Co., Ltd.), Calgary.
Project: 130 miles of 10-in. from Swan Hills area to Edmonton.
Status: Under way.
Contractor: **Mannix Co.,** Calgary, has 10 miles from Swan Hills to Ft. Assiniboine. **Banister-Helm, Ltd.,** has 40 miles from Ft. Assiniboine southward
Completion: November 11, 1958.

• **Independent Pipe Line Co.** (Home Oil Co.), Calgary.
Project: 1,073 miles of 36-in. from Edmonton, Alta., to Superior, Wis.; 946 miles of 34-in. from Superior to Montreal, Que.; 72 miles of 16-in. and 74 miles of 10-in. feeder lines from Calgary to Bellshill Lake, Alta., on the 36-in. line.
Status: Proposed.

• **Interprovincial Pipe Line Co.,** Edmonton.
Project: 82 miles of 24-in. looping in Alberta and Saskatchewan.
Status: Under way.
Contractor: **Piggott Construction, Ltd.,** Calgary.
Completion: September 1958.

• **Mid-Continent Pipe Lines, Ltd.**
Project: 1,500 miles of 30-in. from Edmonton to Chicago, via Saskatchewan, North Dakota, Minnesota, Wisconsin, and Illinois. United States section to be owned by International Oil Pipeline Corp., New York City.
Status: Pending Canadian Board of Transport Commission approval. **W. C. Gilman & Co.,** New York City, has made preliminary study.

• **Peace River Oil Pipe Line Co., Ltd.,** Calgary, Alta.
Project: 8 miles of 6-in., 45 miles of 8-in., and 17 miles of 12-in. from its Fox Creek Pump Station to Windfall, Virginia Hills, and Swan Hills fields in Alberta.
Status: Approved.

• **Producers Pipelines, Ltd.,** Regina, Sask.
Project: 50 miles of 4, 6-in. gathering line extensions in fields in southeast Saskatchewan.
Status: Under way.
Contractor: **Majestic Contractors, Ltd.,** Edmonton.
Completion: October 30, 1958.

• **Westcoast Transmission Co., Ltd.,** Calgary.
Project: Line to parallel its 650-mile, 30-in. gas line from Peace River to Vancouver, B. C.
Status: Under way.

Canadian Products Pipelines

• **Foothills Products Pipe Line, Ltd.** (Pembina Pipe Line Co., Mannix Co., Ltd.), Calgary, Alta.
Project: Gathering system to connect Alta. gasoline plants to trunk line from Alta. to Pacific Coast.
Status: Proposed.

• **Hydrocarbons Pipeline Co.,** Winnipeg, Man.
Project: 800 miles of 6, 8-in. LPG line from near Edmonton to Fort William, Ont.
Status: Has Parliament of Canada approval. Seeking approval of Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board.
Contractor: **Dutton - Williams Brothers, Ltd.,** Calgary, and **A. D. Little Co.,** Boston, are consultants.

Canadian Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.,** Calgary.
Project: 50 miles of 34-in. from Princess to Cavendish, Alta., and 24 miles of 26-in. from Cessford to Princess, Alta.
Status: Under way.
Contractor: **Banister Helm, Ltd.,** Edmonton, Alta.
Completion: September 1, 1958.

• **Alberta & Southern Transmission Co., Ltd.**
Project: 1,300 miles of 36-in. from Alberta, to San Francisco, plus 47 miles of gathering lines.
Status: Planned.
Completion: 1960.

• **British American Oil Co., Ltd.,** Toronto.
Project: 20 miles of 2 to 14-in. in Pincher Creek, Alberta.
Contractor: **Mannix Co., Ltd.,** Calgary, R. L. Tulford, superintendent

• **Canadian Western Natural Gas Co., Ltd.,** Calgary.
Project: 58 miles of 16-in. and 8 miles of 6 to 12-in. from Carbon field to Calgary.
Status: Under way.
Contractor: Company forces.
Completion: September 30, 1958.

• **Northern Natural Gas Co.,** Omaha.
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek, Alberta.
Status: Planned.
Project: 32 miles of 24-in. from Pincher Creek to Montana border to tie in with planned United States line on to Minneapolis.
Status: Planned.

• **Northern Ontario Natural Gas Co., Ltd.,** Port Arthur, Ont.
Project: 90 miles of 10-in. from North Bay to Sudbury, Ont.
Status: Under way.
Contractor: **Mannix Co., Ltd.,** Calgary, Alta., V. D. Worcester, superintendent, office at Verner, Ont.
Completion: Late fall 1958.

• **Northern Ontario Pipe Line Crown Corp.,** Ottawa, Ont.
Project: 675 miles of 30-in. from the Ontario-Manitoba border to near Kapuskasing, Ont. (part of the 2,250-mile Trans-Canada line; will be leased to Trans-Canada Pipe Line Co. with option to buy); 360 miles from Port Arthur to Kapuskasing remains to be laid in 1958.
Status: Under way.
Contractor: **B. C. River Construction, Ltd.,** Longlac, Ont., has 91 miles from Longlac to Shekak River 30 miles west of Hearst, E. L. Maggard, superintendent, office at Longlac, to complete October 1, 1958. **Mannix Co., Ltd.,** Calgary, has 92 miles from 35 miles west of Hearst to Kapuskasing, Odis Hare, superintendent, office at Hearst. **Nelen, Ltd.,** Toronto, Ont., has 63 miles from Port Arthur to Nipigon River. **Majestic Contractors, Ltd.,** Edmonton. Alta., has 71 miles from Broadmore to Longlac. **Morrison-Shivers, Ltd.,** Dryden, Ont., has 48 miles from Nipigon River to Broadmore. **Pentzien Canada, Ltd.,** Toronto, has three major river crossings.
Completion: November 1958.

• **Northwestern Utilities, Ltd.,** Edmonton.
Project: 4 miles of 16-in., 4 miles of 12-in., 4 miles of 10-in., 5 miles of 8-in., 29 miles of 6-in., and 3 miles of 4-in. Pembina field, Alberta, gathering lines, including an 8-in. crossing of Pembina River, and a 16-in. crossing of North Saskatchewan River.
Status: Under way.
Contractor: **Mannix Co., Ltd.,** Calgary, Alta., S. Steffen, superintendent, office at Drayton Valley, Alta.
Completion: September 30, 1958.

• **Trans-Canada Pipe Lines, Ltd.,** Calgary, Alta.
Project: 491 miles of 30-in. from Kapuskasing to Toronto.
Status: Under way.
Contractors: **Grayco Constructors Canadian, Ltd.,** Toronto, has 82 miles from Kapuskasing to Potter. **Majestic Contractors, Ltd.,** Edmonton, has 83 miles from Potter to Kirkland Lake. **Dutton-Williams Bros., Ltd.,** Calgary, has 57 miles from Kirkland Lake to Rib Lake. **Canadian Bechtel, Ltd.,** has 47 miles from Rib Lake to Tilden Lake, H. F. (Hank) Mogg, superintendent, office at Timagami. **Morrison-Shivers, Ltd.,** Dryden, Ont., has 62 miles from Tilden Lake to South River. **H. C. Price Co.,** Bartlesville, Okla., and **Poole Construction Co.**

PIPELINE CONSTRUCTION

have 63 miles from South River to Bracebridge. **Oklahoma Pipe Line Constructors,** Dallas, has 92 miles from Bracebridge to Maple, north of Toronto.

Completion: October 1, 1958.

- **Van Tor Oil & Exploration Co.,** Vancouver, B. C.

Project: Line from British Columbia mainland to Vancouver Island.

Status: Proposed.

Completion: 1960.

- **Westcoast Transmission Co., Ltd.,** Calgary.

Project: 110 miles of 30-in. and 176 miles of 20-in. from East Calgary and Savanna Creek, Alberta, fields to Kingsgate on British Columbia-Idaho border.

Status: Planned.

Completion: November 1, 1958.

Project: Looping of present system to double capacity.

Status: Planned.

Foreign Crude-Oil Pipelines

- **Arabian American Oil Co.,** Dhahran, Saudi Arabia.

Project: 9 miles of 32-in. loop from Abqaiq toward Shedgum.

Status: Planned.

Completion: 1960.

Project: 17 miles of 32-in. extension of loop from Abqaiq toward Shedgum.

Status: Planned.

Completion: 1961.

Project: 9 miles of 30-in. extension of loop from Abqaiq toward Shedgum.

Status: Planned.

Completion: 1960.

Project: 12 miles of 30-in. extension of loop from Abqaiq toward Shedgum.

Status: Planned.

Completion: 1961.

Project: 54 miles of 30-in. loop of Safaniya-Ras Tanura line.

Status: Planned.

Project: 63 miles of 30, 32-in. from Khursaniyah to Ras Tanura.

Status: Planned.

- **Assam Oil Co.,** Digboi, Lakhimpur District, Assam, India.

Project: 600 miles of 20-in. from Nahorkatiya field in Upper Assam to Barauni, India, to connect with Burmah Oil Co.'s proposed 250-mile line from Barauni to Calcutta.

Status: Survey of possible routes under way.

Contractor: **Pipe Line Engineering Co.,** Dallas, is making survey.

- **Bolivia-Paraguay.**

Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.

Status: Planned.

Contractor: **Five Lilles,** a French Combine.

- **Burmah Oil Co., Ltd.,** Glasgow, Scotland.

Project: 250 miles of 20-in. from Barauni to Calcutta, India, extending Assam Oil Co.'s proposed line.

Status: Survey under way.

Contractor: **Collins Construction Co.,** Port Lavaca, Tex., is surveying locations for about 40 river crossings.

- **Cia. Shell de Venezuela.**

Project: 70 miles of 30, 34-in. heated line from Bachaquero to Puerto Miranda, and an unheated 31-in. parallel to the section from Cabimas to Puerto Miranda.

Status: Under way.

Contractor: **Williams Brothers Sudamericana, Ltd.**

- **Colon Oil Co.,** Caracas, Venezuela.

Project: 34 miles of 8-in. from El Rosario to Calvario in Venezuela.

Status: Planned.

Completion: February 1959.

- **Columbian Petroleum Co.**

Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia, S. A.

Status: Under way.

- **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal),** and **Cie. Francaise des Petroles Algerie,** Paris, France.

Project: 450 miles of 16-in. from Edjele field in southeastern Algeria to a Mediterranean port on the Libyan coast.

- **Elburz Oil Corp.**

Project: 1,000 miles of 38-in. to move Qum crude to the Mediterranean.

Status: Planned.

- **Iranian Oil Participants, Ltd.**

Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bandar Mashur line.

Status: Planned.

Project: 50 miles of 26, 28-in. from Gach Saran field to new terminal at Kharg Island in the Persian Gulf.

Status: Planned.

Contractor: A joint venture of **Raymond Concrete Pile Co.** and **Williams Bros. Co.,** Tulsa, **Richard Costain, Ltd.,** and **John Brown, Ltd.,** London, and **Werkspoor & Bredoro,** The Netherlands.

- **Iraq Petroleum Co.,** London.

Project: 600 miles of up to 40-in. from Kirkuk field through Iraq to Turkish port of Iskenderun on the Mediterranean.

Status: Proposed. Survey completed.

Project: 76 miles of 30-in. looping along the Kirkuk-Banias line.

Status: Under way.

Completion: Early 1959.

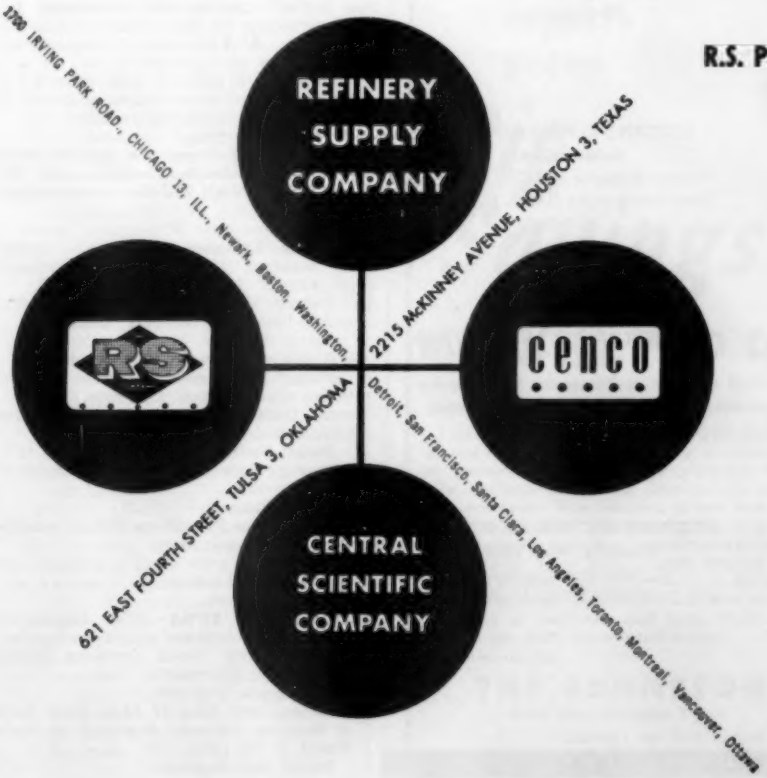
- **Kuwait Oil Co., Ltd.,** London.

Project: 61 miles of 30-in. from Raudhatain area to Ahmadi.

Status: Under way.

Completion: June 1959.

Project: 7 miles of 38, 40-in. No. 11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PIPELINE CONSTRUCTION

Gravity Line from North Ahmadi Tank Farm to North Pier.
Status: Planned.
Completion: December 1958.
Project: 7 miles of 38, 40-in. No. 12 Gravity Line.
Status: Planned.
Completion: April 1959.

• **Middle East Pipeline.**
Project: 1,500 miles of 38, 40-in. from Persian Gulf to Mediterranean at Iskenderun, Turkey.

• **North-West Oil Pipeline Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N. J.) and British Petroleum Co., Ltd.).
Project: 230 miles of 28-in. from refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.
Status: Under way.
Contractor: **W. M. Lyles** jointly with two German steel firms.
Completion: November 1958.

• **Petroleo Brasileiro S. A. (Brazil).**
Project: 40 miles of 12-in. from Catu to Madre de Deus in Bahia.
Status: Under way.
Contractor: **Techint, Inc.**

• **Rotterdam-Rhine Pipeline Co.**
Project: 185 miles of 30-in. from Rotterdam to Ruhr industrial area in West Germany to supply refineries at Godorf, Wesseling, and Gelsenberg.
Status: Preliminary work under way.
Contractor: A group of German and Dutch firms.
Completion: 1960.

• **Royal Dutch-Shell.**
Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through eastern France, Luxembourg, West Germany, Netherlands, and Belgium. Main line to be 30-in.
Status: Considering project as joint venture with several other companies.

• **SOPEG** (construction organization for Cie. Francaise des Petrole (Algerie) and Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie).
Project: 412 miles of 24-in. from Hassi Messaoud field in the Algerian Desert to Bougie on the Mediterranean Coast.
Status: Under way.
Contractor: **Entrepose Co.** and **Ste. Parisienne pour Industrie Electrique** have 281 miles. **SOCOMAN** and **Eau Assainissement** have 131 miles.
Completion: Late 1959.

• **South European Pipeline Co.** (Jersey Standard, Caltex, and 17 European firms).
Project: 932 miles of 30-in. from Marseilles, France, to Hamburg, Germany.
Status: Proposed.

• **Union of Soviet Socialist Republic.**
Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.
Status: Under way.
Project: Line from Russian fields to Czechoslovakia.
Status: Planned.

• **Yacimientos Petroliferos Fiscales (Argentina),** Buenos Aires.
Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Planned.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.).
Completion: Mid-1960.
Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blanca on the coast.
Status: Bids requested.

PIPELINE CONSTRUCTION

Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

- **Yacimientos Petroliferos Fiscales Bolivianos,** La Paz.

Project: 174 miles of 10-in. and 44 miles of 8-in. from Sicasica, Bolivia, to Arica, Chile.
Status: Under way.
Contractor: **Williams Brothers Co.,** Tulsa.
Completion: November 1, 1958.

Foreign Products Pipelines

- **Empresa Nacional de Petroles Government of Chile** and **Cia. de Petroles de Chile (Copec), et al.,** Santiago, Chile.

Project: 75 miles of 10-in. from Chile's coastal refinery at Concon to Santiago.
Status: Planned.
Completion: Late 1958.

- **National Iranian Oil Co.,** Azna, Iran.

Project: 120 miles of 6-in. northward extension of its Abadan-Teheran system.
Status: Planned.
Contractor: **B. & M. Construction Corp.,** Oklahoma City.

- **Yacimientos Petroliferos Fiscales (Argentina),** Buenos Aires.

Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Bids opened August 1958.

Foreign Natural-Gas Pipelines

- **Attock Oil Co., Ltd.,** London.

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.
Status: Planned.

- **Cuban Gas Transmission Co.**

Project: 500-mile line from Campeche area of Mexico across Yucatan and a 150-mile line on the ocean floor to Havana.
Status: Under study by **Ebasco Services.**

- **Ferngas.**

Project: 45 miles of 12-in. from Semmering to Donawitz, Austria.
Status: Planned.
Contractor: **Mannesmann,** a German steel and construction firm.
Completion: Last half 1958.

- **Gaz de France.**

Project: 550 miles of 16 to 24-in. from Lacq field in southwestern France to Paris, plus a 10-in. terminal to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.
Status: Under way.
Contractor: French contractors.
Completion: Line to Nantes to be completed September 1, 1958; line to Lyons, March 1959; line to Paris in 1960.

- **NIOGAS.**

Project: 160 miles of 6, 8, 10, 12-in. from Fischamend field to Vienna and other Austrian cities.
Status: Under way.
Contractor: **Williams Brothers Co.,** Tulsa, and **Costain-John Brown, Ltd.,** London.
Completion: Fall 1958.

- **Petroleos Mexicanos,** Mexico D. F.

Project: 130 miles of 22-in. to parallel a 14-in. line from Renosa to Monterrey.

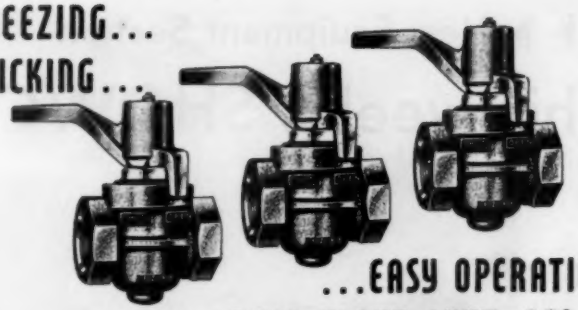
- **Sui Gas Transmission Co.,** Multan, Punjab, India.

Project: 130-mile extension of the new 310-mile, 16-in. Multan-to-Sui, Pakistan, line. Extension will terminate at Lyallpur.
Status: Planned.

- **Yacimientos Petroliferos Fiscales (Argentina),** Buenos Aires.

Project: 1,015 miles of 24-in. from Camp Duran to Buenos Aires.
Status: Under way.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.).
Completion: Mid-1960.

NO FREEZING...
NO STICKING...



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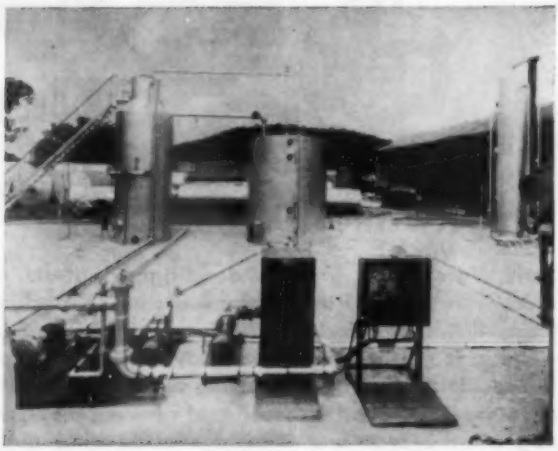

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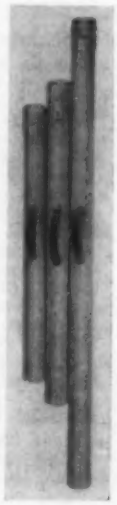

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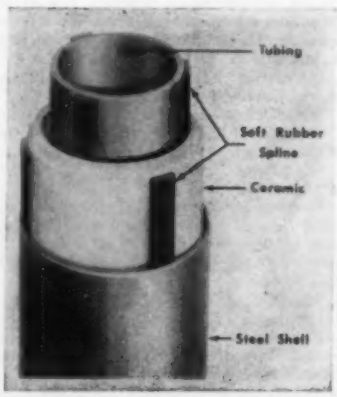


Protector stops sand cutting

. . . due to high-pressure gas-jetting opposite perforations in multiple completions. Called Impenecap, the protective joint is made of an extremely dense, silica-base, ceramic composition. It's said to be harder than topaz, corundum, or sapphire, testing 9.2 on Mohs' Scale as compared to a rating of 10.0 for diamond. The application is designed to protect the ceramic against breakage during and after run-in. Thus a steel outer shell with soft-rubber splines between tubing, ceramic, and shell are used.

It comes in 30-ft. lengths. For lengths greater than 30 ft., special box-and-pin joints are furnished to make up sections to any length. Standard joints, built around 2⅜-in., N-80 tub-

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in OIL AND GAS **JOURNAL** - Issue of August 25, 1958

NAME.....TITLE.....

COMPANY.....

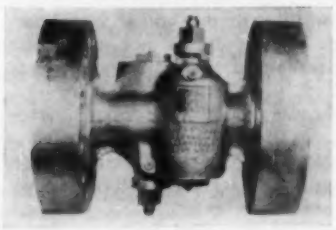
ADDRESS.....

CITY.....STATE.....

DATE.....

ing are available. **Write or call: Plastic Applicators, Inc., P. O. Box 7631, Houston, for details on Impenecap.**

●



Dual completion valve line

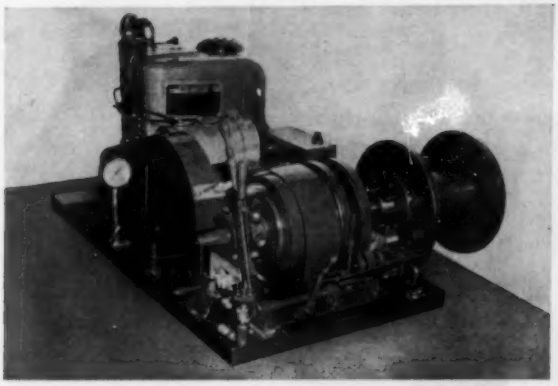
. . . is designed primarily for christmas tree installations for dual-producing zones. Called Hypreseal, the valve features pressure lubrication and sealed-port grooving. This design is suitable for high pressures, elevated temperatures, and other severe conditions.

The dual-completion valve comes in 1½, 1¾, 2, and 2½-in. sizes at 3,000 and 5,000-lb. working pressure. The recessed-body valve comes in 1½, 1¾, 2, and 2½-in. sizes at 2,000 and 3,000-lb. working pressure. **Write or call: Rockwell Mfg. Co., Meter & Valve Div., 400 North Lexington Avenue, Pittsburgh 8, for details on Hypreseal valve.**

●

Pneumatic flow rate transmitter

. . . uses a magnetic method to convert the long linear motion of a rotameter metering float—or any linear motion—into a rotary motion for flow-rate indication, transmission, or alarm, the maker states. False or ambiguous response or readings are eliminated, the maker claims. On top of the unit's magnetic position converter is a flow sensing cam. It is the calibration curve of the rotameter plotted on polar coordinates. Alongside the magnetic position converter is a pneumatic cam follower which is similar in many respects to a pneumatic tracing head. As the metering float moves, the flow sensing cam is turned and the pneumatic cam follower automatically traces the leading edge of the cam and transmits an air signal corresponding to this position or to flow rate. **Write or call: Brooks Rotameter Co., Lansdale, Pa., for details on MPT-50 flow-rate transmitter.**



Reel features detachable spools

. . . permitting one reel to be used at many well sites. For example, one detachable reel unit can be used at different wells with separate spools, releasing the reel unit for other work until necessary to return.

The unit is available in all standard unit drives now manufactured. It's powered by gasoline, diesel, air, or electric motors. The detachable spool capacities are 12,000, 15,000, and 18,000 ft. of 0.072-in. wire line. **Write or call: C. A. Mathey Machine Works, Inc., 212 South Frankfort, Tulsa, for details on detachable spool reel.**

●

Front-mounted winch and mounting kit

. . . for 1958 Chevrolet trucks is now available. It is Model F5C for Chevrolet truck Series 3100, 3600, and 3800, and fits both two-wheel and four-wheel drive trucks.

This new model is rated at 7,500 lb. line pull with breaking point about 15,500 lb. With rollers and brackets, it weighs only 112 lb.

The winch with mounting kit includes all parts necessary for installation such as mounting brackets, cap screws, and vertical and horizontal rollers. The factory-equipped bumper is utilized, resulting in cost savings as well as retention of original appearance. **Write or call: Tulsa Winch Div., Vickers, Inc., 817 East First Street, Tulsa, for details on Model F5C winch and mounting kit.**

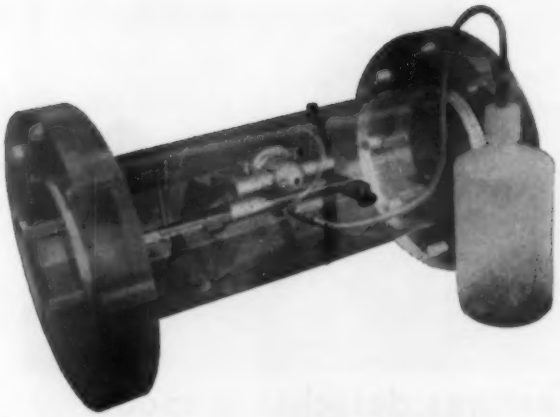
●

Taper-face flange rating

. . . has been increased. The Tube Turn forged-steel taper-face welding neck flange is now recommended for 175-psi. liquid, gas, or air service at 150° F. Originally it was rated at 125 psi. WOG. It is now rated suitable for 125-psi. dry-saturated steam at 353° F.

The new ratings correspond with the steam rating of Class 125 cast iron or semisteel valves. This increases the range in which the flange can be used in steam service. The new flange dimensions match cast-iron flanges and valves having Class 125 flanges in accordance with ASA B-16.1.

One-third to two-thirds lighter than standard ASA 150-lb. welding neck flanges, the new flange reduces both weight and costs, the maker says. **Write or call: Tube Turns Div., Chemetron Corp., 334 East Broadway, Louisville 1, Ky., for details on new taper-face flanges.**



Pipeline sampler assures true test

. . . of fluid flowing through a pipeline by use of an integrating pickup tube. The tube is a rotating probe that progressively samples the complete pipe cross-section.

Attached to an impeller-driven shaft, the probe comprises a rotating tube with a helical slot inside another tube with a straight slot. The resulting aperture sweeps the pipe cross-section to obtain representative sample.

According to the maker, the sampler meets API-ASTM requirements for automatic sampling. After a 1-year test with sour crude in a major pipeline, the sampler required no servicing. No external power is needed. The sampler is immersed in the line fluid. It can be located anywhere in the line. And it can be connected to automatic process controls. Reversing the pump lets it be used as a precision proportional injector for chemicals.

Sample size is easily varied and ranges from 1 to 4 ml. per barrel. Sampling accuracy is almost 100%. The sampler is available in line sizes of 1 through 36 in. Working pressure is almost unlimited.

Potential uses include crude-oil sampling in LACT units, sampling of refinery streams for process control, injection of chemicals and dyes into gasoline and corrosion inhibitors into wells. **Write or call: Cherokee Laboratories, Inc., 3021 Sand Springs Road, Tulsa 7, for details on pipeline sampler-injector.**

●

Self-powered portable pipeline auger

. . . features fingertip-controlled hydraulic power. A self-contained boring unit, the auger is the only piece of equipment needed to bore holes for 2 to 10-in. pipe, the maker says.

A 7½-hp. gasoline engine, equipped with a kick starter, powers the unit by means of a reversing transmission. The engine also supplies power for a centrifugal water pump which forces water through the hollow auger sections. This pump is not used when the machine is boring through sandy soil.

A rotary hydraulic pump develops up to 275 lb. pressure for a 2½-in.-cylinder which feeds and retracts the auger drive. Ratchet-lever or worm-screw feeds are not used. Finger-tip-controlled hydraulic power does the heavy labor. The auger can be positioned in a small bell hole (40 by 108 in., 16-in. deeper than the center line of hole to be bored) and anchored, ready for boring, within a few minutes.

Only 2 and 4-in. auger sections are required. Either of these with 6, 8 or 10-in. reamers, complete holes for pipe up through 10-in. **Write or call: Moorlane Co., 409 East Archer Street, Tulsa 1, for details on portable pipeline auger.**

●

New powered-lifting hoist

. . . called an Auto Crane, has been developed so one man can handle loads up to 1,000 lb., thus eliminating need of helpers. The hoist can be easily installed in the trunk of a car or in the bed or on the side of a pick-up truck. It takes up little space. The hoist runs off the car battery (6, 12, or 24-volts) and is operated by a cable-mounted, movable, hand switch.

Base unit dimensions are 12¾ in. wide, 13½ in. deep, and 17 in. high. The boom telescopes and swings out of way for road travel. The moving mechanism is fully inclosed, except for the cable for hoisting. The unit also comes dolly-mounted for use in shops. **Write or call: Auto Crane Co., Box 3536, Utica Square Station, Tulsa, for details on Auto Crane powered-lifting hoist.**

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

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Described in OIL AND GAS JOURNAL - Issue of **August 25, 1958**

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....

SHOWCASE . . .

New Literature

Bulk plants, bulk trucks

. . . and other equipment used in the oil-well-cementing field and mud service are described in a new 12-page catalog. The new brochure also covers custom-made trailer units and specialized fabrications for the refinery and pipeline field. Custom-designed models for export are shown. **Write or call: Rig Engineers & Fabricators Co., Inc., P. O. Box 7634, Houston 7, for bulk-handling equipment catalog.**

Continuous loss-in-weight feeding systems

. . . for all flowable liquids or solids are described in new eight-page Bulletin 32-R2. The systems maintain accuracy within ½% of set feed rate over the entire range, which may be 10 to 1, 20 to 1, or up to 50 to 1. Capacities are available from 1 to 60,000 lb. per hour. Simplex and duplex systems are adaptable to either local or remote control, and can be used for proportional pacing by mechanical, electrical, or pneumatic means. The systems are factory calibrated and sealed as true scales, requiring no sampling or calibration when installed. **Write or call: Omega Machine Co., 345 Harris Avenue, Providence 1, R. I., for Bulletin 32-R2.**

Midget-type industrial thermometer

. . . that's chromium-plated over a heavy brass armor case is described in a new folder. It has a yellow, flat-bore, mercury-filled tube with sharp, black-etched calibrations. The well is of heavy stainless steel. The catalog number, range, and price for straight-stem and angle-stem thermometers is included in the folder, as well as details about refill tubes. **Write or call: W. H. Curtin & Co., 1800 Sidney, Houston 1, for Industrial Thermometer bulletin.**

400-cycle induction-heating generator

. . . is detailed in new Folder DM-74. The folder describes how it simplifies the preheating and stress relieving of arc-welded joints. The generator, which supplies 400-cycle a.c. to a wire induction-heating coil, is automatically operated by a strip-chart program controller. Any planned program or preheating, soaking, and coling is automatically controlled and a permanent record of every phase of the program is recorded on a strip chart. **Write or call: Hobart Bros. Co., Troy, Ohio, for Folder DM-74.**

Odor-metering apparatus

. . . and techniques for application to industrial odor-control problems are thoroughly covered in a new four-page folder. It discusses in detail facilities for odor measurement, a detailed account of the company's Odor-Meter, and units of odor concentration and quantity. The folder shows the application of an odor inventory and an example of odor-scrubber efficiency based on the inventory. **Write or call: Hemeon Associates, 121 Meyran Avenue, Pittsburgh 13, for Odor Control bulletin.**

Check chart of maintenance painting

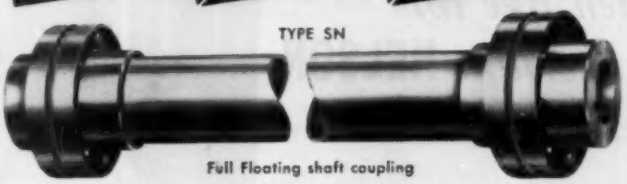
. . . is available to bring you up-to-date on the latest technical recommendations on selecting the right paint for maintenance problems. Included in application recommendations are products based on many of the newest resins, such as Hypalon, Polyurethane, and Saran, as well as rubber and vinyl combinations. The check chart makes selection easy where paint must resist chemicals, heat, and abrasion, and solve other protection problems. **Write**

Protect Your Machinery with

THOMAS FLEXIBLE COUPLINGS

ALL METAL

NO LUBRICATION · NO MAINTENANCE · NO WEARING PARTS



Full Floating shaft coupling

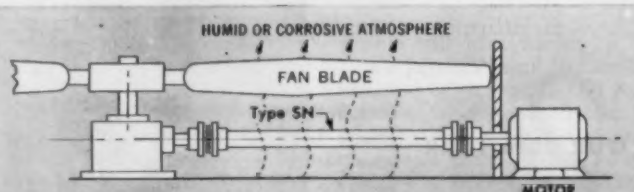
REFINERS! PIPE LINE MEN! DRILLING ENGINEERS! LABORATORY TECHNICIANS!

Thomas Couplings are used to advantage on Pumps, Compressors, Cooling Towers, Rigs or any other tough job where continuous operation and dependability are required.

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings.

UNDER LOAD and MISALIGNMENT ONLY THOMAS FLEXIBLE COUPLINGS OFFER ALL THESE ADVANTAGES.

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance



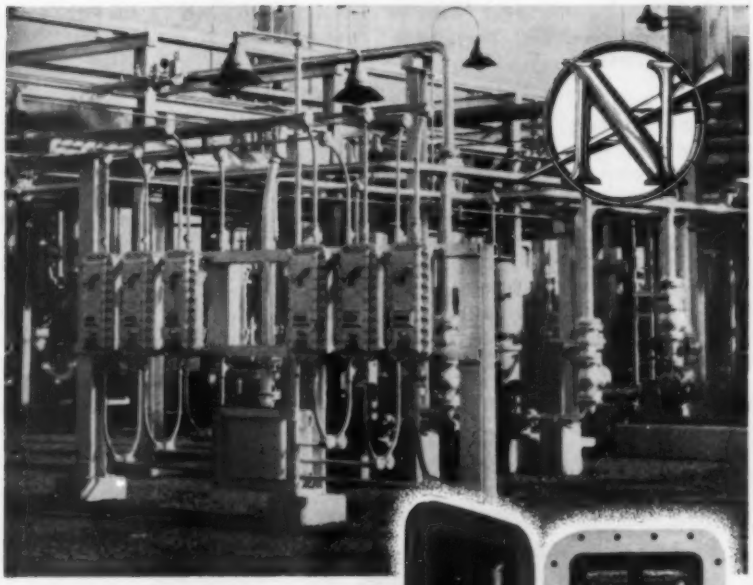
COOLING TOWER INSTALLATION

In the typical cooling tower installation shown above, the motor — outside the humid or corrosive atmosphere — is connected by a floating-shaft coupling to the gear box under the large slow-speed, horizontal-blade fan.

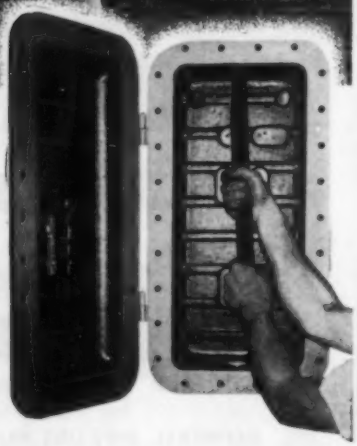
Write for engineering catalog 51A, and the name of your nearest Thomas representative

THOMAS FLEXIBLE COUPLING COMPANY

WARREN, PENNSYLVANIA, U.S.A.



Field installation men like this important **NELSON** *feature . . .*



Designed and built with the field man in mind, Nelson starters arrive at the job site fully assembled and wired. The entire enclosure is made available for cable pulling by removing four screws and lifting out the pan-mounted assembly.

Nelson selects and uses only those components recognized for trouble-free performance, thus reducing maintenance to a minimum.

OUR 20th YEAR

Look in the yellow pages of your phone book for the name of your Nelson representatives, or write the factory for information.

a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

or call: Wilbur & Williams Co., 130 Lincoln Street, Brighton 35, Mass., for Paint Selection Check Chart.

Properties and uses of chlorothene

. . . a Dow inhibited 1,1,1-trichloroethane, are described in a new 16-page booklet. Specified for use in dip, bucket, spray, or wipe methods of cold cleaning, it is one of the safest solvents available from the standpoint of toxicity and also offers a low fire hazard since it has no fire or flash point, the maker says. The new booklet also points out its high solvency, low corrosion, high stability, and economy. In cold cleaning operations, chlorothene can be recovered by distillation. **Write or call: Solvent Sales Dept., The Dow Chemical Co., Midland, Mich., for Chlorothene bulletin.**

Nonpoisonable vanadium catalyst

. . . used in sulfur-burning contact process for the production of sulfuric acid is detailed in new six-page Bulletin 157. The process uses predried air for the combustion of sulfur. Spray type of sulfur burners, waste heat boiler, and economizer are also used—for acid concentrations from 93 to 109%. Typical flow diagram and step-by-step description of the process are included. **Write or call: Chemical Construction Corp., 1733 Commerce Building, Houston 2, for Bulletin 157.**

Side and top-entering mixers

. . . are described in a new four-page bulletin. The mixers come in open and closed-tank types with various arrangements of propellers, turbines, and mixer blades. The bulletin pictures the mixers and cites a number of their advantages. These include a rugged support and rigid alignment of the ground-and-polished shaft. **Write or call: Specialty Engineers Co., 6003 Market Street, Oakland, Calif., for details on Jet-Age mixers.**

Thermocouple tables

. . . are presented in a new 10-page spiral-bound booklet that has two "front covers" and no "back cover." Reading one way, it gives millvolts to degrees and reading the other way it gives degrees to millvolts. It's indexed for further convenience. Tables are based on 150° F. reference temperature to facilitate use of the company's heated type of thermocouple reference junction. **Write or call: Pace Engineering Co., 6914 Beck Avenue, North Hollywood, Calif., for Thermocouple Tables booklet.**

Bethlehem Supply Co. appoints

... W. J. Vark as district manager of the Louisiana Gulf district with headquarters at New Orleans, La. He was formerly district machinery sales representative at New Orleans. He replaces J. B. Ellzey. Vark joined the company in 1950 at Houston as machinery sales trainee.

W. J. Vark

Promotions, reassignments made

... by Schlumberger Well Surveying Corp. G. O. Ellis, formerly district manager at Cody, Wyo., is now senior sales engineer for the northern Rocky Mountain division at Billings, Mont. B. W. Alley, formerly field engineer at Golden Meadows is now sales engineer for the South Louisiana division at New Orleans. Now in the sales department in Houston is W. P. Biggs, who formerly was manager at Pleasanton, Tex. G. M. Lehnert is serving as sales engineer in Tyler, Tex., and W. R. Stallsworth is promoted to district manager at Woodward, Okla.

W. R. Wheeler, Jr., elected

... vice president in charge of sales at American Iron & Machine Works Co., Inc., Oklahoma City, according to M. G. McCool, president. Wheeler joined American Iron in 1935. He has served as field salesman, supervisor of the sales office in Oklahoma City, special representative, assistant sales manager, and sales manager.

W. R. Wheeler, Jr.

Dresser acquires Elgen

... and has merged it into Lane-Wells Co. In announcing the acquisition, J. B. O'Connor, president of Dresser Industries, Inc., John J. Neale, president of Lane-Wells, and Kirby Gee, president of Elgen Corp., said the merger will result in an expanded service organization. The new organization will be known as Lane-Wells Co. and will headquarter in Houston. It will offer advanced Elgen Electrolog and accessory services, in addition to the services already offered by Lane-Wells.

Neale continues as president with Gee as vice president in charge of operations. Other officers include J. D. Hughes, vice president in charge of sales, and J. H. Zanner, vice president and technical director.

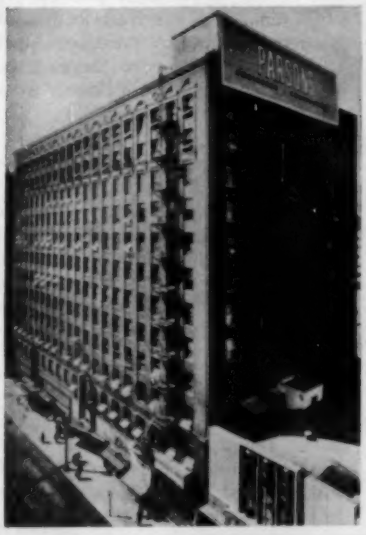
Refinery service extended

... by Tretolite Co., division of Petrolite Corp., in the Rocky Mountain and Louisiana Gulf Coast areas. Philip P. Corneli, formerly chemical engineer for Shell Oil Co., will locate at Baton Rouge, La. Dan Pietuch, refinery service engineer for Tretolite in the Chicago area, has transferred to Billings, Mont., where he will service the Rocky Mountain and western Canadian refineries.

J. B. Beaird Co. promotes

... Gerald Pope, assistant general sales manager, to general manager of sales, according to John L. Tullis, executive vice president. Pope succeeds M. A. Finuf. Pope joined Beaird 11 years ago as a sales engineer in the Shreveport office. Before joining Beaird, he served 5 years with Texas Power & Light Co. in Dallas.

Gerald Pope



Ralph M. Parsons Co. moves

... its headquarters in Los Angeles to this building, formerly occupied by Union Oil Co. of California. The move consolidated over 1,000 administrative and engineering personnel into a single building, with the remaining Parson Los Angeles office staff at the old address.

W. R. Haas appointed

... director of marketing for Monsanto Chemical Co.'s overseas division, Marshall E. Young, vice president and division general manager, reports. Haas, who is now director of sales for the division, replaces S. C. Finnell, Jr. Norman E. Horton, assistant director of sales, St. Louis, Mo., succeeds Haas as director of sales; and Robert L. Vincent, managing director of Monsanto Japan, Ltd., Tokyo, succeeds Horton.

Babcock & Wilcox Co. promotes

... three men in the sales department of the tubular products division, according to Leon B. Wohlgemuth, general sales manager of the division. G. H. Weight, formerly Southwest district sales manager, has been made sales manager, Middle states. He will headquarter in Chicago. J. H. Roach, Houston, is named district sales manager of the Tulsa office. W. C. Mohrman, Tulsa, becomes district sales manager of the Houston office. Weight, who succeeds Wohlgemuth, joined the company in 1926. Roach joined B&W in 1939. Mohrman started his employment at the Houston district office in 1946.

G. H. Weight

J. H. Roach

W. C. Mohrman

Heintz-Hill join forces

In a joint statement Herbert E. Hill, president of Herbert E. Hill Advertising, Inc., and Robert Heintz, president of Heintz & Co., Inc., announced the merger of the Herbert E. Hill advertising accounts and personnel into Heintz. Among the key executive group coming to the Heintz organization is Hill who becomes a vice president of Heintz and a member of the board of directors. B. F. Klein becomes a vice president and a member of the plans board committee and will serve as the technical and industrial director. Robert Lawrence will

become a member of the plans board committee and will serve as art director of the industrial advertising department.

Pipe Linings appoints

... W. D. Thomson to the sales staff, reports R. C. Sargent, division vice president. Thomson comes to the company from Amercoat Corp. and prior to that was assistant sales manager for Gladding McBean Co.

James D. Mixon assigned

... as field service engineer at Beckman/Process Instruments Division office in Chicago, reports Frank Newman, marketing manager. Mixon has been with Beckman Instruments since 1957, having served as lead man for final instrument inspection, scientific instruments division. Prior to joining the company, he worked for North American Aviation, Inc.

Pipe Linings opens sales office

C. O. Davin

... in Fort Worth, Tex., for the states of Texas, Oklahoma, and New Mexico, with C. O. Davin in charge, according to R. C. Sargent, division vice president. Davin has been with Pipe Linings since 1951 and is experienced in all aspects of rehabilitating pipelines in place. Before coming to Pipe Linings, he sold for Warren Electric.

Bucyrus-Erie Co. appoints

... Charles Parthum as sales promotion manager. He formerly was with Harnischfeger Corp., Milwaukee, where he was director of public relations, sales promotion, and advertising. He has also been with MacManus, John & Adams, advertising agency, and Buchen Co. in Chicago.

James K. Logan appointed

... manager of the middle Atlantic area, Catalytic Construction Co. He will work out of the main office in Philadelphia, Pa. He has had 15 years' experience in the design and construction of processing plants in the chemical, petroleum, and allied industries, 6 years of which were devoted to technical sales.

Bill Horton appointed

... sales and service representative in North Texas and Oklahoma for Harold Brown Co., according to Harold Brown, president. Horton will work out of Ardmore, Okla.

G. T. Williamson elected

... to vice president of Tuloma Builders, Inc., according to Clyde W. Wyant, president. D. R. Turner is now manager of engineering. Williamson was formerly chief engineer and will

G. T. Williamson

D. R. Turner

now be in charge of engineering sales and process development for Tuloma's United States and Canadian operations. Turner was formerly project manager with Ehrhart & Associates, San Francisco, and will now have charge of all of Tuloma's engineering, design, and material procurement for both the construction company and pipe fabrication shop.

George Steven appointed

... general manager of the compressor and engine division of Worthington Corp., reports E. J. Tribble, group vice president. Formerly assistant general manager at the Buffalo division, Steven replaces vice president Austin C. Ross, who has retired. Steven joined Worthington at the Cincinnati works in 1923.

Everett J. Long appointed

... as director of the transducer division, Consolidated Electrodynamics Corp., according to K. W. Patrick, vice president in charge of Monrovia, Calif., divisions. Long, who succeeds Patrick, was formerly assistant director for operations of the transducer division. Joining CEC in 1952, he has previously held positions with Austin Co.; Bendix Aviation Corp.; Los Alamos Scientific Laboratories; Rock Island Arsenal, Rock Island, Ill.; and Mutual Engineering Co. In his new post, he will direct all activities of the transducer division.

American Recording Chart moves

... into its new plant in Los Angeles, according to J. W. Dunn, manager, American Recording Chart Co. The new building more than doubles the size of the former plant. Storage facilities for recording charts is increased from 5,000,000 to over 25,000,000. New equipment incorporated includes presses and specially designed precision machines to expedite the manufacture of recording charts to the highest degree of accuracy. A portion of the building will be occupied by Arco Instrument Co. of which Dunn is president.

Harold S. Davis named

H. S. Davis

... as sales manager of the Data-Tape division, Consolidated Electrodynamics Corp., according to Charles C. Snider, sales manager. Davis was a sales engineer, sales manager, and marketing manager at American Electronics, Inc., and also a service engineer and sales engineer with General Electric Co.

Hiller Helicopters announces

... that its corporate name has been changed to Hiller Aircraft Corp. Executive vice president, Edward T. Bolton, stated that the new name had become more suitable because the company activities had been diversified to include other aircraft fields in addition to helicopter production. A step in this diversification was the acquisition by Hiller of Adhesive Engineering Co., San Carlos, Calif.

Robert A. Watson named

R. A. Watson

... field service engineer in the Rocky Mountain area, operating out of Casper, Wyo., for Herb J. Hawthorne, Inc. In making the announcement, J. W. Thigpen, vice president, sales, reported that Watson was formerly party manager for Petty Geophysical Engineering Co.

A & A Supply Co. named

... as area representative for the electric motor division of A. O. Smith Corp., reports W. O. Ansley, A & A general manager. A & A Supply, Abilene, Tex., will represent A. O. Smith in the western section of Texas, including the counties of Hardman, Ford, Knox, Haskel, Jones, Taylor, Runnels, Concho, Menard, Sutton, Crockett, and Terrel, and also New Mexico.

Rolo Manufacturing Co. names

. . . I. B. Allen as Venezuelan representative. Allen was formerly with Stanolind in the United States and was subsequently president of Peticon in Venezuela. He will headquarter in Caracas and will handle Rolo's line of oil metering equipment, including the Hi-Cap metering separator.

H. K. Cropsey appointed

. . . sales manager of the Weldforged Grating Division of Kerrigan Iron Works, Inc., at New York City, reports Philip Kerrigan, Jr., president. Cropsey, who succeeds D. D. Connors, comes to Kerrigan with a 25-year record with J. S. Thorn Co. While at Thorn he served as sales manager.

J&L Steel Corp. adopts

. . . "Jal-Con-Weld" as the trade name for pipe manufactured on its two continuous weld pipe mills now in operation at the company's Aliquippa, Pa., works. The new continuous weld mills incorporate the latest technical advancements for control of quality. The mills produce pipe for oil and gas distribution lines at rates up to 1,000 ft. a minute.

A. O. Smith Corp. announces

. . . the appointment of W. B. Albright as district manager to head midwestern operations for the electric motor division, reports C. M. Poston, general sales manager. Headquartered at Chicago, Albright will supervise sales representatives of the division in Illinois, Wisconsin, Missouri, Iowa, Minnesota, Kansas, Nebraska, South Dakota, and North Dakota. He has been with the division for the past 7 years.

R. R. Pierce named manager

. . . of the corrosion engineering products department of Pennsalt Chemicals Corp., reports Hugh C. Land, general manager of the industrial division. Pierce will be in charge of manufacturing, sales and development for the company's line of corrosion resistant mortars, protective coatings, plastic toppings, and plastics for the fabrication of process equipment used to handle corrosives. He is a veteran of 17 years' experience in plant, technical service, and sales management with Pennsalt. He will headquarter in Natrona, Pa.

Mike N. Hopkins joins

. . . Nocor Chemical Co. in its West Texas staff. He will handle sales of corrosion inhibitors and scale preventives. He formerly served with Cardinal Chemical, Inc., and earlier represented Green Contracting & Engineering Co. of Wichita, Kans.

W. W. Harris named vice prexy

W. W. Harris

. . . of marketing, according to R. R. Newquist, president of Roots-Connersville Blower Division of Dresser Industries, Inc. Harris will have responsibility for the marketing of Roots-Connersville equipment throughout the United States and Canada. He comes to the division from General Electric Co.

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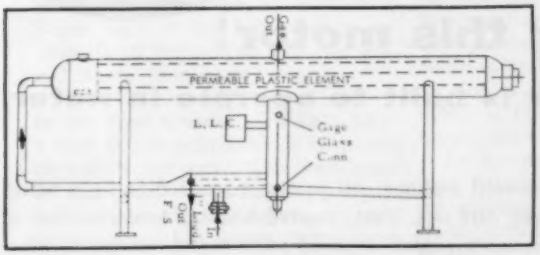

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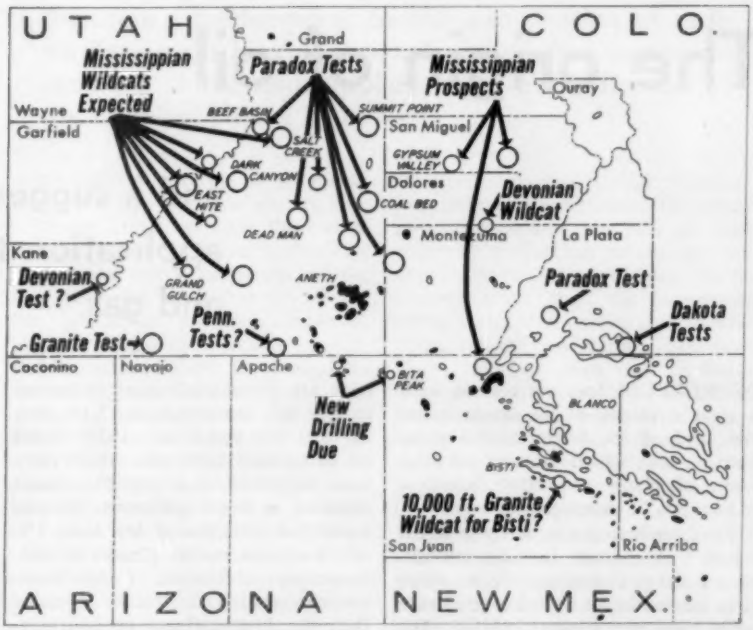
What's Hot?

"It all depends on who you are, and where your interest lies."

BY FRANK J. GARDNER



THESE CIRCLES spotlight things to come in the great Four Corners oil bowl. Wildcats are expected in all these places within the next year or two.

"WHAT'S THE HOTTEST area in exploration today?" It's a rare day when that question isn't fired at some member of the Journal's exploration staff. It's not too hard to answer, if you rely on lease sales and rig counts. But when you get into intangibles, it's a different story.

"Intangibles" in this sense covers a lot of territory: research targets, future considerations, secret plans, and personal opinion, to name just a few of the factors. The pendulum of rig activity swings constantly, and on this basis, the hottest areas today might be the Williston basin, the Anadarko basin, or the Paradox basin. If it were not for a sad economic plight, western Canada would be on top. Alaska is hot, but only from a leasing and interest standpoint. To Michiganders, Scipio field is the hottest thing in years. It all depends on who you are and where your interest lies.

In the Four Corners . . . Let's take a look at the intangibles in just one of today's hot spots. The comments on this page will be based on logic, future plans, hearsay, rumor . . . and maybe even a few secrets. But if they materialize into facts over the next few months, then the Four Corners will undoubtedly be the hottest spot in the nation.

In the March 31, 1958, issue of the Journal, this column, referring to the Paradox country, predicted that ". . . a wildcat play will push production north and west to the Colorado River within 2 years." With luck, it can easily happen. Here's why:

Deals are cooking . . . See all those circles on the map? Each one is a definite prospect for future drilling . . . and soon, possibly this year. None of these is a current operation, although some of the tests shown on the map may be active by the time you read this. Four Corners operators are busily putting together deals in all these places.

Of special interest are the numerous Mississippian targets grouped along and southeast of the Colorado River. Mississippian deals are brewing all through this area, and more than a dozen wildcats are already going down to look at those rocks. Some have failed, at Dark Canyon Unit, for instance, but more are in the works.

To the north and east, note that new Paradox-Pennsylvanian wildcats are aborning in at least eight remote spots, from Beef Basin Unit on the northwest in Utah to the Bondad area of southwestern Colorado. More Mississippian rumors are sketched in here, too; two for Colorado and one for northwestern New Mexico.

All over the map . . . Blank spots on the map of the San Juan basin fields are going to be filled in by some of these yet-unannounced wildcats. Most will aim for the Dakota-Cretaceous sands, but one major company is rumored to be fishing around for support for a 10,000 or 12,000-ft. wildcat within the limits of Bisti field; this is supposed to take it to the granite, but nobody knows for sure.

Arizona is in for its share, too. New drilling is definite here. Humble Oil & Refining Co. has announced a 6,400-ft. Devonian test in Section 10-41n-28e, in Apache County. This would be the first new drilling in East Boundary Butte field, site of Arizona's one lonely oil well. Later, Humble is expected to try to stretch Arizona's one-well Bita Peak gas field eastward into San Juan County, New Mexico, with a Pennsylvanian wildcat.

And the temperature rises . . . Why all this fever? Note how the activity centers of tomorrow encircle Aneth and its sister fields. In the short space of 2 years, these producers have outstripped mighty Rangely as the largest daily source of crude in the Rockies. That's quite a record, and its happened in one of the toughest, most remote corners of the country—the Four Corners. Pure Oil Co.'s success in the Mississippian far to the north in San Juan County, Utah, has thrown the whole Paradox basin wide open to new potentials. The oil fields of northwestern New Mexico have zoomed their production. And Arizona has hardly been touched.

Hot? You bet. Hotter? No doubt about it. Hottest? Well it depends on who you are and where your interest lies.

Some geochemical thoughts on

FUNDAMENTALS OF GEOCHEMISTRY
PART 5—CONCLUSION

The origin of oil

and a suggested approach for its application to the search for oil and gas.

BY BARTHOLOMEW NAGY
Fordham University

PETROLEUM does not contain such a clear evidence of its source material, and of its developmental processes as coal, which contains the remnants of plants and other botanical indications of development.

Furthermore, crude oil is a liquid which can migrate through the minute pores of sedimentary rocks where it is located in an intimate admixture with inorganic mineral matter. The layers of solid coal stay where they were deposited during sedimentation and through textural, physical, and chemical changes they can bear witness to the physical-chemical environments to which they were subjected after burial. Therefore, an attempt to evaluate petroleum formation must be based on seemingly less meaningful observations.

There are two basic facts known. First, crude oil is composed chiefly, but not entirely, of hydrocarbons; and second, crude oil is found in sedimentary rocks. A third may be added to these two fundamental statements, namely that there is no great abundance or accumulation of hydrocarbon compounds, (or related organic molecules which can be converted to hydrocarbons by a simple and uniform process), in the plant and animal kingdoms. One is, therefore, forced to seek a mechanism which can account for the chemical synthesis of hydrocarbons, under sedimentary environments, from ordinary and average plant and/or animal debris.

The conditions controlling the chemical evolution are further defined by the presence of porphyrins and other heat-sensitive constituents in crude oil, (which are known to decompose at relatively low temperatures), and also by chemical and geological data which makes the hypothesis that hydrocarbons were formed from coal seem unlikely. Smith (1952) reports that hydrocarbons are present in recent sediments in very low concentrations, 2-19 parts per 100,000, and Trask (1938) found no extractable fatty oils, which have been suggested as a possible source material, in recent sediments. He also noted that cellulose is less than 1% of all organic matter present in contemporary sediments. Furthermore, modern analytical studies revealed that the hydrocarbons or hydrocarbon-type molecules present in recent sediments appear to differ in their elementary constitution from fossil hydrocarbons.

These observations may serve as further restrictions on the formulation of petroleum genesis mechanisms. They suggest not only that there was no preferential selection of petroleum source materials, but also that apparently there was not even a preferential accumulation of degraded, hydrocarbon precursor-type organic compounds in the sedimentary basins at the time of sedimentation.

A purely bacteriological process of hydrocarbon development from complex plant and animal matter too seems to be unlikely, although a certain degree of microbial decomposition of the organic debris did, in all certainty, take place. The production of methane by bacterial action has been observed, but Stone and ZoBell (1952) reported that they were unable to produce hydrocarbons from the bacterial decomposition of higher fatty acids.

They found, however, what they believed were traces of hydrocarbons in certain bacterial cell structures. They noted that at the present there is practically no evidence as to what constitutes the end product of bacterial decomposition of marine organic matter. Considering some of the principles of sedimentation, oxidation-reduction potentials in the mud, production rates, and other factors outlined in previous chapters, it is not unlikely that these end products may be substantially different, caused by the difference in environments.

Two significant factors . . . At first glance, all this may appear somewhat discouraging, leaving seemingly little on which to base a reasonable explanation of petroleum evolution. A closer look at the picture, however, reveals the presence of two significant factors:

- First, it is known that a great variety of organic compounds can be synthesized and decomposed by microbial action in soils and that the inorganic and organic constituents of soils together form the sediments which are incorporated into the newly formed sedimentary rocks.

- Second, the evolution of sedimentary rocks from the loose sediments, is in effect an active chemical system, where inorganic mineral matter is crystallized out from solutions, and older mineral grains are being dissolved and/or altered. The organic compounds incorporated into the sediments must not stay unaffected in such an active chemical system. The microbial chemistry of soils and sedimentary rock formation (diagenesis) together include so many chemical variables that it might not be unreasonable to expect to find among them mechanisms capable of hydrocarbon production.

The Chemistry of Rocks

Sedimentary rocks are composed of the following inorganic compounds, silica (quartz), hydrous aluminum and/or magnesium silicates (micas and mica type minerals), K, Na and Ca silicates (feldspars) and calcium and calcium magnesium carbonates (calcite and dolomite, respectively). The physical chemistry of these min-

eral systems has been the subject of intense geochemical research during recent years. The atomic structures of these minerals have been determined, the temperature and pressure ranges within which they form stable phases have been studied, their solubilities in various solutions were investigated, etc.

There is an abundance of basic scientific data concerning the chemistry and evolution of sedimentary rock minerals and sedimentary rocks in recent geological literature. Furthermore, careful examination of sedimentary rocks by conventional and modern analytical tools (such as the petrographic microscope and X-ray diffraction spectometer) have also supplied important indications of the chemical history of rocks. It can be shown that a part of the quartz carbonate material, and the mica type clay mineral, illite and chlorite content of the rocks was often formed after the deposition of the sedimentary debris. Some of these inorganic solids crystallizing out in the rock, in situ, remain to be colloidal-sized; others are of that size before they are fully grown.

Modern silicate chemistry notes the catalytic character of colloidal-sized silicate compounds. The catalytic action of minerals in petroleum refining operation and in possible petroleum genesis mechanisms has been proposed before. Francis (1928) noted the effect of montmorillonite type clay minerals (Fuller's earth) on hydrogen disproportionation of certain unsaturated hydrocarbons leading to cycloparaffins and aromatic hydrocarbons. Montmorillonite type minerals are often present in shales and other sedimentary rocks.

Gayer (1933) noted that a large number of paraffin hydrocarbons (at least 24) are formed by the effect of Fuller's earth and other silica alumina catalysts during isobutane-butene alkylations. Brooks (1950) suggested that a similar mechanism may be responsible for the large number of hydrocarbons present in petroleum.

Frost (1945) and Panchenkov, Topchieva, Battalova and Panchenkov (1951) studied the catalytic cracking activity of a series of synthetic silica and alumina catalysts and noted that the maximum cracking effect was produced by a catalyst which had the same chemical composition as montmorillonite clay, $Al_2O_3.4SiO_2.xH_2O$.

Grenall (1949) suggested that the catalytic nature of montmorillonite clays is related to their proton donor acid nature. There are theoretical reasons to believe that this may be pronounced during the crystallization of the clays, although the effect of water, always present in sediments, may alter their catalytic activity.

"There is an abundance of basic scientific data concerning the chemistry and evolution of sedimentary rock minerals and sedimentary rocks in recent geological literature. Furthermore, careful examination of sedimentary rocks by conventional and modern analytical tools . . . have also supplied important indication of the chemical history of rocks."

Brooks (1953) explains the formation of petroleum from a primitive bitumen or heavy petroleum, of the type suggested by Barton (1934) for the petroleum precursor material, through the catalytic action of mineral matter in rocks involving carbonium ion reactions.

One of the attractive features of Brooks' theory is that he is able to account for large proportions of cycloparaffins in petroleum with the carbonium ion mechanism. The inability to explain the presence of cycloparaffins in crude oil was one of the major difficulties with several proposed petroleum genesis theories.

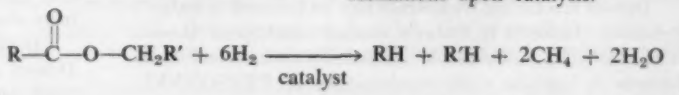
The Formation of Oils

The available geological, chemical and microbial information may be fitted together into the following picture: Ordinary plant and animal debris on land is decomposed by soil microorganisms into a variety of organic compounds. Following erosion these compounds are transported to the sedimentary basins either as water solutions, colloidal suspensions in water, adsorbed molecules in ion exchange positions and between basal planes of clay minerals or, finally, as solid particles. In the marine muds and under anaerobic conditions they are incompletely oxidized. After the onset of diagenesis certain molecules are subjected to the proton donor catalysis of crystallizing mineral solids and, consequently they are converted to hydrocarbon compounds.

It is possible that those biochemical degradation products which are most intimately associated with the catalyst, such as the organic compounds adsorbed at the base exchange positions on clays, are most likely to be affected by the catalytic hydrocarbon formation mechanism. The resultant hydrocarbons are, due to their relatively nonreactive nature, less susceptible to further attack from the inorganic solids than the oxygenated compounds still awaiting catalysis. Therefore, the hydrocarbons can, most likely, migrate with less restraint through the clay containing rock than the noncatalyzed compounds. They can be driven, together with water, by mounting pressures developing in the geosyncline or by the compaction of the sedimentary matter.

The migrating hydrocarbons can be concentrated and contained in suitable traps (for example, in such structures as were found by Kidwell and Hunt (1957) in the deltaic sediments of the Orinoco River in Venezuela), whereas the organic matter which was not subjected to catalytic transformation remains to be dispersed in the rock strata in the original trace amounts.

The principal feature of this outline, the suggestion that the average organic decomposition products in soils can be converted to hydrocarbons in the sedimentary rocks, is based on a mechanism proposed by Meinschein and Kenny (1957), who suggested that wax esters (of the type of soil waxes) can be subjected to such transformations upon catalysis.



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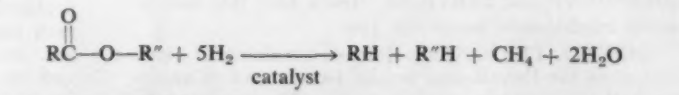

where R and R′ are alkyl groups.

The suggestion of Meinschein and Kenny is in agreement with the work of Connor and Adkins (1932) who found that alcohols and esters yield hydrocarbons upon hydrogenolysis.

The catalytic transformation of ordinary organic decomposition products into hydrocarbons may also conceivably occur in certain soils (clay minerals are known to crystallize out and to undergo structural transitions in soils). In such a case the resultant hydrocarbons could be transported either as colloids or as very dilute

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solutions in water to the sedimentary basin where, after deposition, they could be subjected to the same concentration mechanisms.

Fordham experiments . . . A word of caution (together with some encouragement) needs to be raised regarding the catalytic action of minerals in petroleum evolution. Exploratory experiments were recently performed at Fordham University, investigating the interaction of micaceous minerals with soil-type waxes under simulated physical-chemical environments known to be prevalent in sediments after deposition. Chrysotile, having the composition of $Mg_6Si_4O_{10}(OH)_8$, is the magnesium analogue of the sedimentary rock constituent clay mineral, kaolinite, $Al_4Si_4O_{10}(OH)_8$. Several investigators succeeded in synthesizing this kaolinite type mineral from its oxide components at low temperatures; and Epprecht (1947) even observed the formation of this compound at room temperatures and atmospheric pressures from the components, magnesium chloride and sodium silicate solutions. Due to its ease of crystallization and because this reaction is known to proceed in the presence of NaCl in aqueous solutions, an attempt was made to synthesize chrysotile from stoichiometric mixtures of

$$MgCl_2.6H_2O \text{ and } Na_2SiO_3.9H_2O$$

in the presence of beeswax and water. Meinschein and Kenny (1957) suggested that the soil waxes, which they found to be similar to beeswax, can be converted to hydrocarbons by a suitable catalytic reaction.

The object of the present study was to explore the possibility that the physical-chemical environment prevalent in sediments after deposition, with the aid of active catalysts (the crystallizing clay minerals), can effect such a transformation of the soil waxes. The inorganic salt-wax-water mixtures were placed in pressure-vessels and subjected to 150° C. temperature and less than 40-psi. pressure for a period of 1 week. The reaction temperature was slightly higher than the ordinary temperature of sediments in order to speed up the crystallization of the silicates. The system also included the atmospheric gases.

After the completion of the runs the reaction products were identified with mass spectrographic, infrared and X-ray diffraction techniques. The reaction pressure-vessels contained valves permitting a simple transfer of the gaseous reaction products into mass spectrographic analysis after the completion of the runs. Mass spectrographic analysis of the gaseous products (performed by subjecting the pressure vessels, which have been connected to the mass spectrograph, to both room and dry-ice temperatures) showed two major results:

- First, the oxygen content of the gases in the pressure vessels was reduced to trace amounts.
- Second, the CO_2 content in the vessels containing the magnesium and silicate salts was much higher than in a control run containing wax and NaCl solution alone.

It was not possible to ascertain whether traces of methane and other low - molecular - weight hydrocarbon constituents of the gases were related to the chrysotile-wax reaction, because it is known that untreated beeswax contains some hydrocarbons.

The infrared spectra of untreated beeswax showed two major absorption maxima, one at 3.5 μ and another one at 5.76 μ. The former is caused by the carbon-hydrogen association; the one at 5.76 μ is the result of the ester carbonyl absorption (beeswax is an ester of organic acids and alcohols). Minor absorptions above 7.5 μ were also observed in the spectra.

Infrared spectral analysis of the high molecular weight organic reaction products showed an almost complete elimination of the prominent ester carbonyl absorption at 5.76 μ, but it did not show any changes in the carbon-hydrogen band at 3.5 μ. The reaction did not cause any noticeable shifts in absorptions, such as the development of the acid carbonyl band or the OH absorption of alcohols. The weak absorptions above 7.5 μ, present in the original beeswax sample, were largely unaffected by the reaction. With this exception the infrared spectra of the organic reaction products were similar to those shown by Meinschein and Kenny of saturated hydrocarbons prepared by hydrogenation of the soil wax ester.

There was no difference noted between the spectra of runs containing magnesium and silicate salts and wax and those of the control run which contained wax and brine alone.

The inorganic reaction products were analyzed by X-ray diffraction, after they were separated from the organic matter by dissolving this latter substance with organic solvents. The presence of NaCl crystals in the dried, solid residue was confirmed, together with a substance which led to X-ray diffraction effects similar to those noted by Epprecht for his low-temperature synthesis of chrysotile.

It has to be pointed out that the characteristic 001 reflection of chrysotile and kaolinite clay was absent, which was also the case in Epprecht's experiments. It is likely, therefore, that the magnesium hydrous-silicate reaction product consists of poorly crystalline and colloidal-sized, skeleton structures. The quality of X-ray reflections did not permit ascertaining whether chrysotile was the only synthetic mineral present, or whether others, such as quartz, were also synthesized.

Infrared, mass spectrographic, and X-ray diffraction analyses indicate that subjecting the wax samples to such physical-chemical environments as are generally considered to be common in sedimentary rock formation, does not lead to paths hostile to hydrocarbon evolution. However, the catalytic action of mineral matter seems to have been left largely undecided by the results. Further experimentation along these general directions may lead to some interesting discoveries.

The separation question . . . The proposed mechanism of petroleum formation is based on the diversity of organic chemical reactions in sediments, in soils, and during diagenesis. A few of these reactions are known to produce hydrocarbons. The question of prime importance, therefore, is not how hydrocarbons were formed, but rather how they were separated from other organic compounds and how they were consequently concentrated in certain strata of rock.

Recent experiments show that mixtures of organic compounds, present in the sediments in small quantities, may be separated and concentrated by basically chromatographic type process. The chemical literature contains several hundred publications describing the chromatographic separation of the mixtures of a variety of organic compounds in columns packed with clay minerals, quartz sand, silica gel, calcium carbonate, etc., under particular laboratory conditions. The chromatographic process is the separation of colored, but usually colorless compounds during flow through columns ordinarily packed with finely divided solids and effected by ion-exchange, adsorption and the so-called partition mechanisms. Experiments conducted at Fordham University led to the separation and concentration of various organic compounds, eluted with seawater, on layers of illite clay and sand under simulated geological conditions. Indications are that in rocks, traces of hydrocarbons and other organic compounds are subjected to chromatographic separation and concentration processes.

Remarks on Applications

Applied methods, such as soil analysis, stratigraphic and lithofacies studies, various techniques related to the wettability of rock and even electrical logging (for example the factors contributing to the character of the K factor in the SP formula), can benefit from basic organic geochemistry. A specific problem, however, requires a specific treatment using information and a framework of thought borrowed from fundamental geochemistry. The geochemical principles can be applied with maximum success only if they are regarded as a control mechanism, a system of scientific checks and balances on applied endeavor. Such a usage, which at present can be complicated, will result in success.

In soil analysis . . . To give one example, application of modern principles of carbon-compound geochemistry may result in significant developments in soil-analysis methods. Soil analysis is a subject which drew praise as well as much sharp criticism. It is not impossible that a form of hydrocarbon seepage, under special geological conditions, might have taken place. On the other hand, if such a process did exist, it needs to be proved.

It is strange, considering the promise which soil analysis holds, that little effort was put forth to introduce modern geochemical principles to the study of this problem. Such an approach alone can fully explain and develop this technique. If it is permissible to venture a prediction at this time, one can visualize a reevaluated soil-analysis method, fortified with information from fundamental geochemistry, as a powerful tool for the exploration geologist. This can be significant at times such as the present when the cost of exploration is increasing so rapidly.

Considering the complex nature of the organic compounds produced in soils by the action of microorganisms, one of the tasks of the geochemist may be to identify indicator compounds in soils, produced by the interaction of escaping reservoir fluids, crystallizing inorganic mineral matter and the biochemical decomposition products of plant and animal life.

The practical aspects . . . Some of the principles of carbon compound geochemistry may be applied to exploration for oil and gas deposits. The following outline summarizes and emphasizes certain subjects discussed in greater detail in the previous chapters, with a slant toward the practical aspects of petroleum exploration encountered in the development of new basin areas. This summary may be

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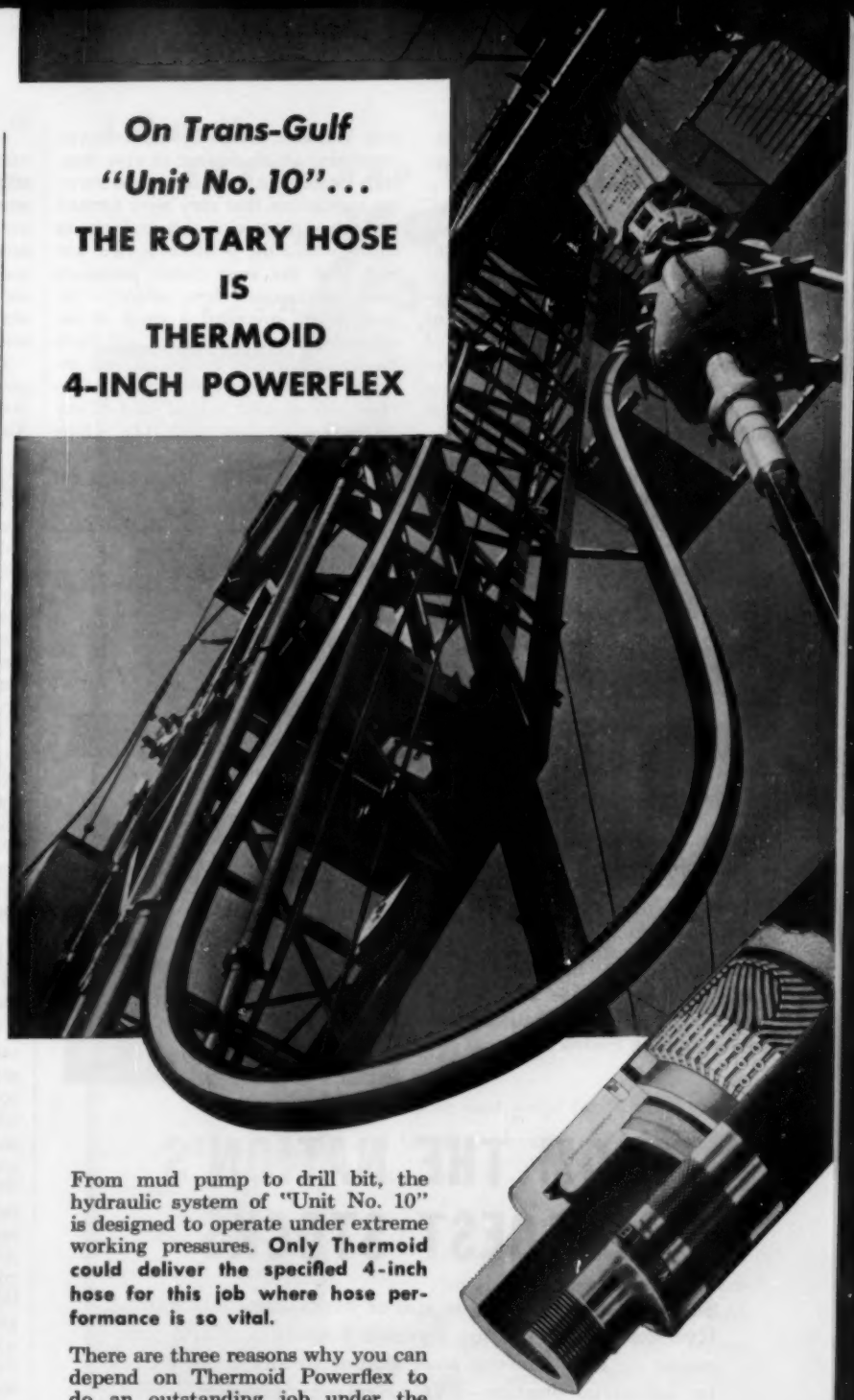

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applied with modification to the extension of already available production.

(1) A general study of the erosion, sedimentation and diagenetic history of the area is made with the techniques of sedimentary petrography, particularly with the aid of petrographic microscopy of thin sections of rocks. The samples which are studied can be obtained from outcrops; at this stage of the investigations, one microscopic-thin section from one major lithofacies may suffice.

(2) The sedimentary petrography data are assembled and added to geophysical and other geological information available from the area. Rocks containing an abundance of clay minerals (shales and shaly sand) and showing indications that they were formed through a process of slow erosion, in basins where the production rate was high and the mud redox potentials were continuously low, under a climate which preceded a series of oscillations between cold-wet and more moderate climatic conditions, are selected. These indications may be obtained from microscopic and X-ray diffraction studies under (1). These selected rocks are suspected petroleum source rocks and they are singled out for further study.

(a) They are subjected to a detailed microscopic-thin section study. At this stage of the investigations it may be necessary to prepare a thin section at every 1-in. or 2-in. interval of the cross-section of a selected, particular rock strata or laminae. The microscopic studies are to confirm the general picture of erosion, sedimentation, and diagenetic history obtained at (1).

(b) The clay content of the rock is analyzed by X-ray diffraction and differential thermal analysis techniques. This is to complete the picture derived at (2a).

(c) The catalytic activity of the rock is estimated by measuring the surface area of the bulk rock sample with suitable techniques, such as the gas adsorption (BET) method. The assumption is that the higher the surface area the more catalytic minerals are present and the more likely the rock will catalyze the oxygenated biochemical decomposition products of organic debris to hydrocarbons.

(d) The amount and the types of organic compounds present in the selected rock sample are analyzed. It may be sufficient to determine the relative amount of oxygen present in the organic constituents of the rock and express it as the ratio: amount of hydrocarbons/amount of oxygenated compounds. If this ratio is high (even if the total amount of organic matter is low) it is likely that the mineral matter effected a hydrocarbon evolution process during diagenesis.

(3) The results of (2a), (2b), (2c) and (2d) will point at the most likely petroleum source rocks. One is faced now with the question: Where did the oil migrate to? The data obtained under (1) and particularly under (2a) and (2b) should help to trace the path. As an additional test the organic molecular ratios suggested under (2b) may be measured along suspected paths of migration; a continuous increase in such a ratio might indicate that one is approaching the oil and gas deposit. Samples for this last test will most likely have to be obtained from a bore hole with techniques allowing collection of samples which are least contaminated by drilling mud solids and mud filtrate (side wall sampling).

The dynamic character of sedimentary geochemical relationships were emphasized in previous chapters. Because of this, such a scheme must be always modified to meet particular geological requirements. Petroleum exploration based on carbon-compound geochemistry does not involve much expensive instrumentation, but it involves nonroutine analysis by a number of trained specialists. It is an

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expensive undertaking but not as expensive as drilling one dry hole.

EDITOR'S NOTE: This concludes Dr. Nagy's five-part series on geochemistry. Previous parts appeared in the June 30, July 14, July 28, and August 11 issues of The Oil and Gas Journal. Requests for reprints may be addressed to the author or to The Oil and Gas Journal, 211 South Cheyenne Avenue, Tulsa.

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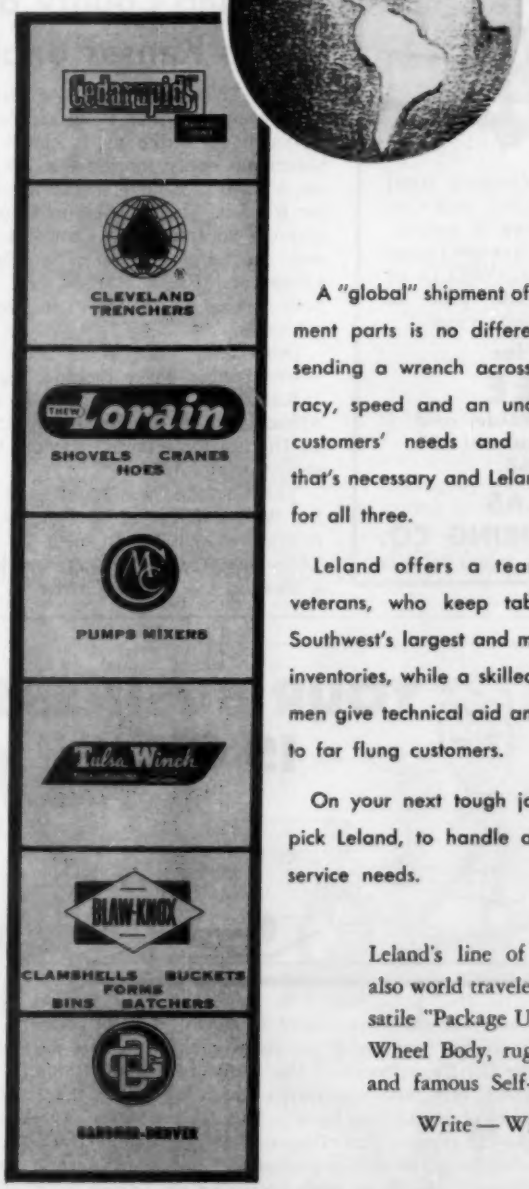

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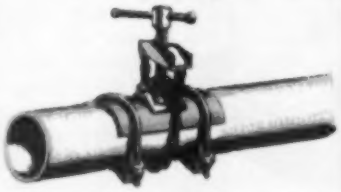

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Sherman County discovery sparks Kansas exploration

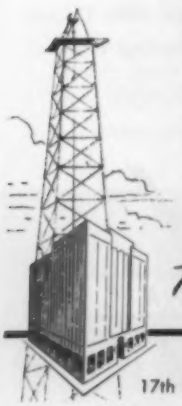
FOLLOWING Phillips Petroleum Co.'s recent important Cherokee Pennsylvanian oil strike at 1 Llanos in Sherman County, northwestern Kansas, a wave of drilling spread through the Rawlins, Thomas, Sherman County area. So far, the 1 Llanos is the only successful discovery, but the 2 Llanos and the 1 Hartley "A" are both seeking production in the Pennsylvanian.

Other tests active in the area are: Warren, Shear, Miles Jackson, Parker 1 Ruda in NE SW 14-4s-33w. This Arbuckle test is drilling below 4,565 ft. The last top reported was the Mississippian at 4,488 ft.

The Cherokee was found at 4,315 ft.; Warren Shear et al 1 Bowles is drilling below 1,200 ft. in C SW SW 24-4s-34w; the same operators have a location made at 1 Grover in SW NE 32-5s-33w; Phillips has a tight hole at 3 Shermanville in C NE SE 21-6s-38w; Shear et al have a location in C SW SE 9-6s-39w at 1 Zimbelman; Phillips has a tight hole at 5,530 ft., total depth, at 6 Goodland Prospect in NW NW NE 29-8s-38w.

Two wildcats were dry in Thomas County, one at Shear et al 1 Foster in SW SW SW 14-6s-32w, and 1 Briney in C SW NW 6-6s-36w; Petroleum, Inc., quit at 1 Falconer in C SE SW 6-5s-36w after going to 5,242 ft. The last top was the Arbuckle at 5,192 ft. There were some oil shows on a drill-stem test at 4,459-72 ft.

STRIKE at 1 Llanos in northwestern Kansas has set off a wave of drilling in that area.



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Service, condensate well depth breakdown, July

	Service wells					Field condensate wells							Wildcat condensate wells				
	A	B	C	D	E	C	D	E	F	G	H	I	E	F	G	H	I
Kansas	...	2	8	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Kentucky	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Michigan	8	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
New York	...	20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ohio	...	7	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Oklahoma	2	16	3	1	...	...	1	5	2	...	1	...	...	1	...	...	1
Pennsylvania	21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
West New Mexico	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Texas	20	9	9	5	...	...	1	14	24	7	2	...	1	6	2	...	...
Dist. 1	...	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	...
Dist. 2	...	...	...	...	...	...	...	2	3	1	...	...	...	1	...	...	...
Dist. 3	...	1	1	...	...	...	...	...	4	3	1	...	...	1	...	...	...
Dist. 4	...	...	...	...	...	...	...	3	5	1	...	...	1	2	1	...	...
East	...	...	...	...	...	...	...	3	1	...	...	...	...	...	...	...	...
Dist. 7-B	9	1	1	2	...	...	...	1	...	...	...	...	...	...	...	...	...
West	...	2	1	...	...	...	1	3	...	...	1	...	...	...	...	...	...
Dist. 9	11	5	6	3	...	...	...	...	...	...	...	...	...	...	...	...	...
Dist. 10	...	...	...	...	...	...	...	2	10	...	...	...	...	2	1	...	...
Louisiana	...	...	...	...	...	1	...	1	2	5	10	7	...	...	...	2	...
South	...	...	...	...	...	1	...	1	2	5	7	5	...	...	...	2	...
Offshore	...	...	...	...	...	...	...	...	...	...	3	2	...	...	...	...	...
Mississippi	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...
Southeast New Mexico	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...
Arkansas	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Total United States	**52**	**64**	**23**	**6**	**1**	**1**	**2**	**20**	**30**	**12**	**13**	**7**	**2**	**8**	**2**	**3**	**1**

Strike in California

RECENT DISCOVERY of deep oil production at El Rio, in Ventura County, California, is being confirmed in the completion by Standard Oil Co. of California and Western Operations, Inc., of a good oil producer in their second well.

Production is from the 10,800-ft. zone in which the discovery well was completed. In the first 22 hours, the new well made 328 bbl. of 26°-gravity oil, flowing by pump agitation. Hole was drilled to 12,533 ft.

Location is about 3,000 ft. northeast of the field's first well, perforated at 10,810-11,267 ft.

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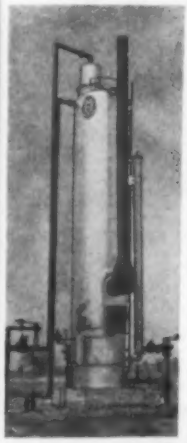

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Despite dry hole in Oregon, drillers are active . . .

ABANDONED as dry at 7,919 ft. was Sunray Mid-Continent Oil Co.'s wildcat in the southeast Prineville area of Crook County, Oregon.

The venture was a joint effort with Standard Oil Co. of California, Lloyd Corp. and McCullough Oil Exploration Co. of California, Inc. on the 159,000-acre Bear Creek Anticline unit.

Standard of California is the principal lease-holder on this central Oregon opeartion.

In Louisiana's Leeville field . . .

EXTENSIVELY DRILLED Leeville field, in the coastal marshlands of Lafourche Parish, Louisiana, is adding another good oil reservoir to the multiplicity of productive zones already found.

The new pay, in The Texas Co. 207 L.L.&E., is perforated at 10,944-50 ft. It flowed at the daily rate of 216 bbl. of 35.1°-gravity oil while testing through 3/32-in. choke. Flow was under pressure of 3,000 psi. with ratio of 1,371 cu. ft. per bbl.

The well is dually completed. Its other pay, perforated at 10,064-82 ft., has produced in other wells. It flowed at the daily rate of 156 bbl. of 33.8°-gravity oil through 3/32-in. choke. Gas-oil ratio was 1,588 cu. ft. per bbl. Pressure was 2,990 psi.

Leeville's multiple sands range in depth from 3,000 ft. to below 14,000 ft.

Illinois' Richland County . . .

ROSICLARE LIME is proving productive in a new Illinois discovery located 9 miles northeast of Olney in Richland County.

The discovery is by Perry Fulk at his 1 Stoltz, spotted in 35-5n-14w.

The well is being completed on the pump with its Rosiclare pay open at 2,883-87 ft. An open-hole drill-stem test of the pay from 2,875 ft. had gas at the surface in 5 minutes, and recovered 2,540 ft. of oil and 60 ft. of oil-cut mud. Tester was open 2 hours. Bottom-hole pressure was 1,050 psi.

Texas Panhandle's Ochiltree County . .

NORTHWESTERN Ochiltree County, Texas Panhandle, gained a Lower Morrow sand gas discovery 4 miles northwest of Farnsworth townsite, and nearly 3 miles west of present Morrow gas production.

Completion gage was 1,370 M.c.f.d. of gas, plus 2½ bbl. of distillate per 1 M.M.c.f., from perforations between 8,068-8,283 ft. Location is in Section 7, Block 12, H&GN Survey. The well was originally drilled dry in 1956 to 8,404 ft.

And Texas' Winkler County

NORTHWESTERN Winkler County gained a Bone Spring discovery at Cities Service Oil Co. 1-B Tubb.

Completion potential was 156 bbl. of 47°-gravity oil a day flowing through 20/64-in. choke, from perforations at 9,767-76 ft. Gas-oil ratio was 9,044:1. Tubing pressure was 675 psi. Operators had drilled to 11,461 ft., then plugged back for completion.

The Bone Spring is composed of sands and dark limestones at the base of the Delaware Mountain group, and is Lower Permian in age. Location of Cities Service's new producer is 15 miles northwest of Kermit, in Section 14, Block C23, in PSL Survey.

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Total July completions, exploration and development

TOTAL COMPLETIONS

	Total	Crude	Cond.	Gas	Dry	Service	Footage
Alabama	1	1	0	0	0	0	11,508
Alaska	2	0	0	0	2	0	23,811
Arizona	1	0	0	0	1	0	1,683
Arkansas	62	35	1	2	24	0	218,154
California	133	72	0	5	56	0	630,731
Colorado	87	12	0	8	67	0	450,222
Florida	1	0	0	0	1	0	10,993
Illinois	243	102	0	7	134	0	582,841
Indiana	90	37	0	0	53	0	149,472
Kansas	371	177	0	17	166	11	1,279,779
Kentucky	158	74	0	16	67	1	256,206
Louisiana	279	133	28	18	100	0	2,209,248
North	100	43	0	16	41	0	338,521
South	143	68	23	2	50	0	1,491,094
Offshore	36	22	5	0	9	0	379,633
Michigan	63	18	0	2	25	18	159,428
Mississippi	37	17	2	0	18	0	376,397
Missouri	1	0	0	0	1	0	2,386
Montana	12	7	0	0	5	0	63,089
Nebraska	67	23	0	0	44	0	408,548
New Mexico	206	95	2	68	41	0	998,142
West	110	28	1	66	15	0	484,295
East	96	67	1	2	26	0	513,847
New York	42	21	0	0	1	20	58,040
North Dakota	52	23	0	0	29	0	318,996
Ohio	104	48	0	26	20	10	270,377
Oklahoma	545	284	11	29	199	22	1,857,887
Pennsylvania	100	37	0	35	7	21	142,528
Tennessee	1	0	0	0	1	0	600
Texas	1,589	872	57	79	538	43	6,380,560
Dist. 1	64	23	3	3	35	0	194,132
Dist. 2	54	13	7	7	27	0	325,716
Dist. 3	110	35	9	4	60	2	758,862
Dist. 4	105	27	13	5	60	0	560,195
East	120	68	4	0	48	0	517,779
Dist. 7-B	251	124	1	10	103	13	658,665
West	426	325	5	3	90	3	1,903,513
Dist. 9	339	206	0	10	98	25	901,404
Dist. 10	120	51	15	37	17	0	560,294
Utah	36	22	0	1	13	0	193,713
West Virginia	64	13	0	45	6	0	176,548
Wyoming	69	27	0	6	36	0	334,221
July 1958	4,416	2,150	101	364	1,655	146	17,566,108
June 1958	3,903	1,896	84	281	1,543	99	16,042,821
Cum. 1958	27,404	13,535	664	2,070	10,456	679	114,634,479
Cum. 1957	30,024	15,705	265	2,175	11,246	633	125,171,061

D.D. = 36: Calif. 5, Kans. 1, Ill. 3, Okla. 13, Wyo. 7, Dist. (2) 5, Dist. (4) 1, Dist. (1) 1.

WILDCAT WELLS

	Total	Crude	Cond.	Gas	Dry	Footage	C.T.	Act. op.
Alabama	0	0	0	0	0	0	0	18
Alaska	2	0	0	0	2	23,811	0	1
Arizona	1	0	0	0	1	1,683	1	5
Arkansas	13	0	1	1	11	55,853	0	92
California	45	7	0	1	37	194,952	5	144
Colorado	57	2	0	1	54	299,385	0	106
Florida	1	0	0	0	1	10,993	0	2
Illinois	46	3	0	0	43	103,273	18	370
Indiana	31	5	0	0	26	48,187	70	99
Kansas	85	15	0	2	68	316,749	11	354
Kentucky	21	9	0	1	11	31,673	140	155
Louisiana	31	2	2	0	27	250,138	0	441
North	14	2	0	0	12	62,785	0	194
South	17	0	2	0	15	187,353	0	202
Offshore	0	0	0	0	0	0	0	45
Michigan	19	2	0	0	17	54,788	43	98
Mississippi	14	4	1	0	9	139,325	0	39
Missouri	1	0	0	0	1	2,386	1	0
Montana	5	1	0	0	4	22,751	1	56
Nebraska	26	3	0	0	23	154,133	0	49
New Mexico	26	2	1	0	23	131,263	45	192
West	11	0	1	0	10	42,653	8	116
East	15	2	0	0	13	88,610	37	76
New York	1	0	0	0	1	3,940	42	21
North Dakota	20	3	0	0	17	115,033	0	59
Ohio	2	0	0	1	1	8,306	103	181
Oklahoma	87	19	2	5	61	396,814	109	797
Pennsylvania	2	0	0	0	2	7,589	95	81
Tennessee	1	0	0	0	1	600	1	1
Texas	322	34	9	5	274	1,520,266	77	1,035
Dist. 1	28	2	0	0	26	86,612	0	39
Dist. 2	18	2	1	2	13	112,130	0	48
Dist. 3	33	1	1	1	30	271,105	0	73
Dist. 4	32	4	4	0	24	188,914	0	71
East	34	2	0	0	32	167,168	0	56
Dist. 7-B	66	12	0	1	53	198,078	0	67
West	60	6	0	0	54	267,155	28	459
Dist. 9	41	5	0	0	36	145,151	49	134
Dist. 10	10	0	3	1	6	83,953	0	88
Utah	10	0	0	1	9	46,673	0	66
West Virginia	1	0	0	0	1	6,744	64	115
Wyoming	21	0	0	2	19	99,313	4	137
	891	111	16	20	744	4,046,621	830	4,714
	787	79	9	22	677	3,630,435	727	4,664
	5,447	546	90	164	4,647	25,599,377	4,574	....
	6,759	729	60	249	5,721	32,668,101	....	....

TOTAL WELLS

	Total	Oil	Gas	Dry	Service	Footage	Cum. 1958
Alberta	169	110	27	24	8	882,241	926
Saskatchewan	62	40	4	18	0	274,217	410
Manitoba	6	4	0	2	0	11,663	64
British Columbia	8	4	2	2	0	41,562	60
Northwest Territories	0	0	0	0	0	0	7
Western Canada	245	158	33	46	8	1,209,683	1,467

WILDCATS

	Total	Oil	Gas	Dry	Footage	Cum. 1958
Alberta	20	2	3	15	139,086	267
Saskatchewan	12	2	0	10	61,479	100
Manitoba	2	0	0	2	7,504	7
British Columbia	4	0	2	2	24,228	44
Northwest Territories	0	0	0	0	0	7
Western Canada	38	4	5	29	232,297	425

Texas' Tri-Channel field extended

THE RECENTLY opened Tri-Channel field on the east side of Corpus Christi Bay, in Nueces County Texas, is being extended ½ mile south by its second well.

Union Oil Co. of California, which discovered the field and drilled the second well, already is well under way on its third test another ½ mile farther south.

The new field is west of the expansive Redfish Reef field and about 2 miles offshore from the San Patricio County shoreline.

Completion of the second well is from a Frio pay at 8,036-46 ft. which flowed at the rate of 31 M.M.c.f.d. of gas, open flow, with gas-liquid ratio of 41,300 cu. ft. per barrel. Pressure on tests through ¼-in. choke was 2,659 psi.

The 8,000-ft. sand is a shallower Frio zone than that of the discovery well, perforated at 8,343-53 ft. The latter well, completed in June, was good for 21 M.M.c.f.d. of gas.

July footage breakdown

	FIELD WELLS					WILDCAT WELLS			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	11,508								
Alaska									23,811
Arizona									1,683
Arkansas	109,590		5,311	47,400			9,379	4,906	41,568
California	348,356		20,620	66,803		43,036		5,276	146,640
Colorado	50,789		31,621	68,427		11,085		4,380	283,920
Florida									10,993
Illinois	249,752		2,622	227,194		8,586			94,687
Indiana	55,060			46,225		9,085			39,102
Kansas	522,809		58,088	348,197	33,936	58,434		10,225	248,090
Kentucky	95,040		44,110	84,666	717	11,690		1,425	18,558
Louisiana	986,578	334,376	75,370	562,786		12,457	27,246		210,435
North	113,980		57,369	104,387		12,457			50,328
South	664,061	262,785	18,001	358,894			27,246		160,107
Offshore	208,537	71,591		99,505					
Michigan	51,293		4,983	25,867	22,497	6,394			48,394
Missouri									2,386
Mississippi	140,981	9,709		86,382		40,490	14,542		84,293
Montana	38,568			1,770		2,935			19,816
Nebraska	123,471			130,944		19,159			134,974
New Mexico	466,216	8,265	305,029	87,369		14,392	6,240		110,631
West	125,161		297,798	18,683			6,240		36,413
East	341,055	8,265	7,231	68,686		14,392			74,218
New York	27,050				27,050				3,940
North Dakota	124,536			79,427		19,231			95,802
Ohio	131,109		66,327	41,252	23,383			3,822	4,484
Oklahoma	821,463	69,856	130,854	399,525	39,375	93,337	23,472	29,817	250,188
Pennsylvania	33,154		64,090	15,099	22,596				7,589
Tennessee									600
Texas	3,018,806	399,354	286,075	1,073,126	82,933	167,272	82,067	32,104	1,238,823
Dist. 1	44,933	29,660	10,042	22,885		11,621			74,991
Dist. 2	60,250	50,989	19,316	83,031		7,968	9,085	8,812	86,265
Dist. 3	195,257	85,614	18,353	187,579	4,954	10,546	9,502	10,512	240,545
Dist. 4	83,211	69,062	15,953	203,055		21,558	35,652		131,704
East	251,723	28,349		70,539		13,695			153,473
Dist. 7-B	279,900	5,158	35,329	119,807	20,393	45,217		3,780	149,081
West	1,428,295	36,817	6,211	157,634	7,401	36,670			230,485
Dist. 9	483,342		61,444	161,282	50,185	19,997			125,154
Dist. 10	191,895	93,705	119,427	71,314			27,828	9,000	47,125
Utah	125,677			21,363				922	45,751
West Virginia	28,777		125,797	15,230					6,744
Wyoming	114,483		31,976	88,449				12,079	87,234
Total U. S.	**7,675,066**	**821,560**	**1,252,873**	**3,517,501**	**252,487**	**517,583**	**162,946**	**104,956**	**3,261,136**
Western Canada	780,052		84,405	67,544	45,385	19,955		44,641	167,701
Alberta	588,323		75,436	34,011	45,385	11,899		32,131	95,056
Saskatchewan	170,236		8,969	33,533		8,056			53,423
Manitoba	4,159								7,504
British Columbia	17,334							12,510	11,718

Oil strike follows Texas gas discovery

THE RECENT DISCOVERY of Pettus gas production at Balderas, in southern Duval County, is being followed with the completion of a good oil well in a slightly deeper zone.

Both the discovery gas well (1 Elegio G. Canales) and the new oil producer, only 1,200 ft. east on the same lease, were drilled by Farenthold & Pitcairn.

The former was completed last June with open-flow potential of 3,200 M.c.f.d. of gas from pay at 5,076-88 ft. The oil well is rated good for 120 bbl. daily, tested through ⅛-in. choke, with pay at 5,106-09 ft.

The two wells are in a corner of the county near the Jim Hogg County line on the west, and the Brooks County line on the south.

Deeper pay extends Texas' Cooper field

A NEW dual-completion in the Bob Cooper area, 15 miles southwest of Falfurrias, in northern Brooks County, gives this field its third well, its third and deepest producing zone, and a half-mile extension, all in one.

The well, Hillcrest Oil Co. 3 Jack Casey, is productive of gas and condensate from pays at 5,822-27 ft. and 6,167-72 ft. The upper sand is the 5,800-ft. sand productive in Hillcrest's 2 Jack Casey, nearest well northeast. It is rated good for 2,800 M.c.f.d. of gas, open-flow, with yield of 10 bbl. of condensate per 1 M.M.c.f.

The lower zone is in a new pay for the field. It flowed at a calculated open-flow rate of 14 M.M.c.f.d. with 15 bbl. of condensate per 1 M.M.c.f.

The field's discovery well, 1 Jack Casey, drilled by Bridwell Oil Co., is oil-productive from a shallower sand, perforated at 5,667-75 ft. It was completed in March 1955 with a flow of more than 125 bbl. per day through ¼-in. choke. It is 3,400 ft. northeast of the second well.

All producing zones are in the Frio section.

How July field wells broke down by depths

	OIL WELLS									GAS WELLS									DRY HOLES								
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Alabama	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arkansas	2	15	10	4	3	1	...	...	...	...	...	...	...	1	...	...	...	...	...	3	5	3	2	...	...	...	...
California	3	10	10	16	10	9	6	1	...	...	...	1	...	3	...	...	...	...	3	3	5	3	4	1	...	...	...
Colorado	...	1	1	1	7	...	...	...	...	1	1	...	...	5	...	...	...	...	...	1	1	4	6	1	...	...	...
Illinois	17	27	53	2	...	...	...	...	...	7	...	...	...	...	...	...	...	...	20	21	50	...	...	...	...	...	...
Indiana	5	23	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	18	3	...	...	...	...	...	...
Kansas	...	40	79	38	5	...	...	...	...	...	...	5	8	2	...	...	...	...	1	12	48	34	3	...	...	...	...
Kentucky	29	32	3	1	...	...	...	...	...	2	4	5	4	...	...	...	...	...	26	25	5	...	...	...	...	...	...
Louisiana	5	26	8	4	11	34	27	13	3	1	6	5	...	1	5	...	...	...	2	6	13	6	8	14	12	9	3
North	4	22	7	2	5	1	...	...	...	1	6	5	...	1	3	...	...	...	2	5	13	5	3	1	...	...	...
South	1	4	1	2	4	21	22	11	2	...	...	...	...	...	2	...	...	...	...	1	...	1	3	11	10	7	2
Offshore	...	...	...	...	2	12	5	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	2	1
Michigan	...	2	8	5	1	...	...	...	...	...	1	1	...	...	...	...	...	...	...	1	5	2	...	...	...	...	...
Mississippi	...	...	...	...	1	1	10	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	3	2	3	...	1
Montana	...	1	1	...	1	3	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...
Nebraska	...	...	...	2	18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	19	...	...	...	...
New Mexico	1	8	22	25	23	2	12	...	...	...	5	24	8	30	1	...	...	...	1	1	6	4	3	...	3	...	...
West	1	3	3	3	18	...	...	...	...	...	5	23	7	30	1	...	...	...	1	...	2	...	2	...	...	...	...
East	...	5	19	22	5	2	12	...	...	...	...	1	1	...	...	...	...	...	...	1	4	4	1	...	3	...	...
New York	...	21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
North Dakota	...	...	8	...	3	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	3	5	...	...	...
Ohio	9	2	36	1	...	...	...	...	...	2	9	11	3	...	...	...	...	...	7	2	8	2	...	...	...	...	...
Oklahoma	49	71	69	29	35	11	1	...	...	1	1	2	5	13	2	...	...	...	34	39	22	23	15	5	...	...	...
Pennsylvania	...	37	...	...	...	...	...	...	...	...	...	...	35	...	...	...	...	...	...	...	5	...	...	...	...	...	...
Texas	110	174	260	119	113	49	11	2	...	1	19	30	4	15	5	...	...	...	34	54	53	32	56	33	1	1	...
Dist. 1	8	4	8	...	1	...	...	...	...	...	...	2	1	...	...	...	...	...	4	2	...	...	3	...	...	...	...
Dist. 2	...	...	1	4	5	1	...	...	...	...	...	4	...	1	...	...	...	...	...	1	3	2	3	5	...	...	...
Dist. 3	4	...	8	3	6	12	...	1	...	...	...	1	...	1	1	...	...	...	...	1	7	3	10	8	...	1	...
Dist. 4	3	3	7	6	4	...	...	...	...	...	1	3	...	1	...	...	...	...	3	...	6	4	13	9	1	...	...
East	11	12	14	7	17	5	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	1	8	1	...	...	...
Dist. 7-B	23	39	17	25	8	...	...	...	...	...	...	7	...	2	...	...	...	...	14	17	8	6	5	...	...	...	...
West	...	31	153	48	50	25	11	1	...	1	...	2	...	...	...	...	...	...	1	7	6	8	10	4	...	...	...
Dist. 9	61	81	14	25	18	2	...	...	...	...	...	...	...	10	...	...	...	...	10	24	17	8	3	...	...	...	...
Dist. 10	...	4	38	1	4	4	...	...	...	...	18	11	3	...	4	...	...	...	...	...	4	...	1	6	...	...	...
Utah	...	...	...	...	22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3	...	...	...	...
West Virginia	...	9	4	...	...	...	...	...	...	...	25	11	8	1	...	...	...	...	...	3	...	2	...	...	...	...	...
Wyoming	4	1	8	6	5	3	...	...	...	...	...	...	...	1	3	...	...	...	2	2	2	2	4	5	...	...	...
Total United States	**234**	**500**	**584**	**253**	**258**	**122**	**68**	**16**	**4**	**15**	**71**	**95**	**75**	**72**	**16**	...	...	...	**136**	**192**	**234**	**121**	**129**	**66**	**19**	**10**	**4**
Western Canada	...	18	9	58	53	16	...	...	...	...	13	9	4	1	1	...	...	...	...	3	6	6	1	1	...	...	...
Alberta	...	14	7	18	53	16	...	...	...	...	9	9	4	1	1	...	...	...	...	3	4	...	1	1	...	...	...
Saskatchewan	...	1	1	36	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	2	6	...	...	...	...	...
Manitoba	...	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
British Columbia	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTE: A = 0-1,250 ft.; B = 1,250-2,500 ft.; C = 2,500-3,750 ft.; D = 3,750-5,000 ft.; E = 5,000-7,500 ft.; F = 7,500-10,000 ft.; G = 10,000-12,500 ft.; H = 12,500-15,000 ft.; I = 15,000 ft.

How July wildcat wells compared by depths

	OIL DISCOVERIES									GAS DISCOVERIES									DRY HOLES								
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Alaska																									2		
Arizona																				1							
Arkansas													1							3	4	2	1	1			
California	2		1			3	1							1					14	3	1	7	7	1	4		
Colorado				1	1								1						2	1		16	35				
Florida																									1		
Illinois		1	1	1															10	16	17						
Indiana	1	4																	11	13	2						
Kansas			7	7	1								1	1						4	31	29	4				
Kentucky	3	6									1								4	5	1		1				
Louisiana					2															1	7	1	2	4	11		1
North					2															1	7	1	2	1			
South																								3	11		1
Offshore																											
Michigan			2																1	6	6	4					
Missouri																				1							
Mississippi					2			2															4	1	1	3	
Montana			1																			3	1				
Nebraska					3																	5	18				
New Mexico		1					1												3	4	5		7	1	1	2	
West																			3	1	1		5				
East		1					1													3	4		2	1	1	2	
New York																						1					
North Dakota			1		1	1															6	5	4			2	
Ohio														1								1					
Oklahoma	2	3	2	3	5	3	1							1	4				14	9	4	14	14	3	2		1
Pennsylvania																					2						
Tennessee																			1								
Texas	1	6	5	10	6	3	2	1				1	1	1	1	1			24	48	45	43	65	40	9		
Dist. 1	1						1												8	6	5	2	4		1		
Dist. 2				2								1		1						2			6	5			
Dist. 3							1									1			1			1	7	17	4		
Dist. 4		1	1			2													2	2	2	5	5	7	1		
East					1	1													2	3	4	4	17	1	1		
Dist. 7-B		3	3	3	3								1						9	16	11	9	7	1			
West		1		2	2			1											1	7	15	12	12	6	1		
Dist. 9		1	1	3															1	12	8	9	6				
Dist. 10															1							1	1	3	1		
Utah										1										1	1	1	6				
West Virginia																							1				
Wyoming											1						1		1	3	6	1	4	4			
Total United States	**9**	**21**	**20**	**22**	**21**	**10**	**5**	**3**		**1**	**2**	**1**	**6**	**7**	**1**	**2**			85	119	138	133	174	55	31	7	2
Western Canada				3	1									3			2			3	7	4	6	7		2	
Alberta				1	1									1			2			2	5		2	4		2	
Saskatchewan				2																	2	3	3	2			
Manitoba																				1			1				
British Columbia														2								1		1			

NOTE: A = 0-1,250 ft.; B = 1,250-2,500 ft.; C = 2,500-3,750 ft.; D = 3,750-5,000 ft.; E = 5,000-7,500 ft.; F = 7,500-10,000 ft.; G = 10,000-12,500 ft.; H = 12,500-15,000 ft.; I = 15,000 ft.

New Data Books on 1957 New Mexico Drilling

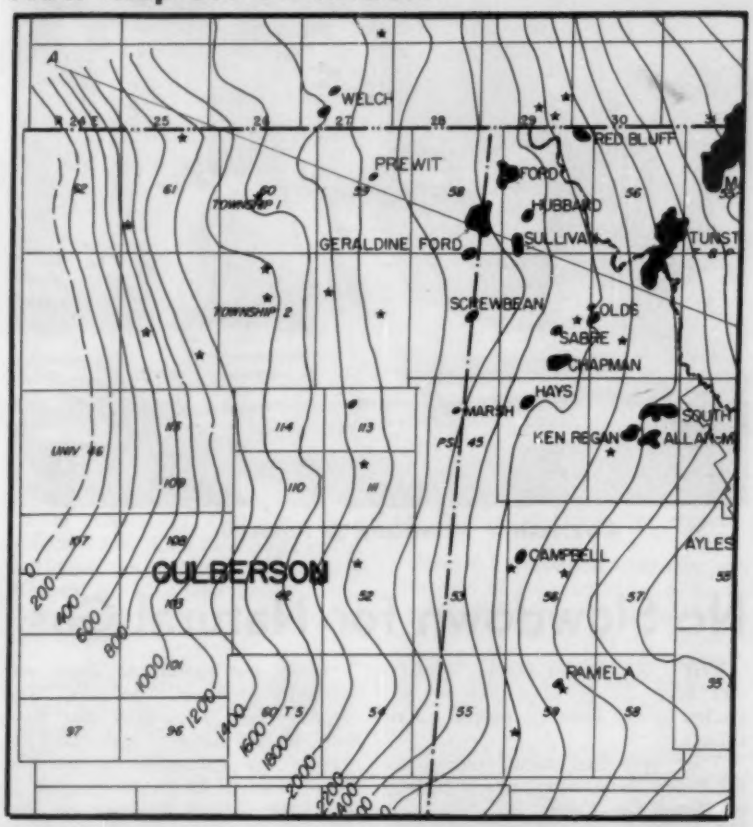
The New Mexico Bureau of Mines and Mineral Resources has issued two books on drilling, discoveries and development of oil and gas fields in New Mexico during 1957.

Circular 51 is titled "Subsurface Completion Data of Wells Drilled for Oil and Gas During 1957." This book lists all wells drilled in the state during the year, by county, company, and field, with a separate listing of wildcats. Data include well unit, location, completion date, initial production, elevation, total depth, pay top, whether shot or acidized, and size and depth of oil string.

Circular 50 is titled, "Petroleum Developments in New Mexico During 1957." This book contains a drilling and production summary of New Mexico during 1957, well illustrated with charts and graphs. Other data include a discussion of exploration by counties; total completions by counties with a comparison with the previous year and county outline maps showing locations of discoveries.

Both circulars are 8½ by 11-in. size, in attractive paper-bound covers. They may be ordered from New Mexico Bureau of Mines and Mineral Resources, Campus Station, Socorro, N. M.

New map for oil finders



A HOT SPOT for shallow prospectors—the northern portion of Delaware basin, in West Texas and Eddy and Lea counties, New Mexico—has attracted shallow exploration over the past several months. During the first half of this year some 10 new pools were opened in Texas, plus 2 in New Mexico. The main objective is the Delaware sand, although a few of these discoveries were in a higher pay member, still in the Delaware mountain group of upper Permian age. The current drilling picture of shallow wildcats is indicated by stars which have been superimposed on the above map. Each star represents a location or drilling well. The "contour" map here is a portion of a new map developed by Southwest Mapping Co., Fort Worth. Purpose of the map is to show operators, contractors, supply men, and others how deep they can expect to find the Delaware sand throughout the Delaware basin. The map is not intended as a subsurface structure map since the contours have been drawn to show depth to the sand from the surface. Fields on the map are areas which have Delaware sand production.

Successful Wildcats

TEXAS

Jim Hogg County: Neville G. Penrose, Inc., and J. R. Howe 3-E Carlos Palacios et al, Block 224, Pippin Subd., El Randado Grant (2½ miles southeast of Randado). IP 37.88 BOPD (net), 19% water, 26/256-in., 42°, GOR 681 cu. ft. per bbl., TP 280 psi., perforations 3,211-17 ft. (Yegua-Rosenburg). TD 3,225 ft. (New field discovery.)

McMullen County: Standard Oil Co. of Texas 2-A Clifton Wheeler 1, T. R. Kuykendall Sur., A-125 (3 miles northeast of Tilden). IP 68.3 BOPD (net), 70% water, 7/32-in., 26°, GOR 150 cu. ft. per bbl., TP 280 psi., perforations 3,526-30 ft. (Carrizo-Wilcox). TD 3,685 ft. (New pay in Henry-Edwards field.)

Starr County: Wood Brothers & Langham 1 Domingo L. Garza, Tract 144, Porcion 85 (9 miles northeast of Rio Grande City). IP 34.38 BOPD, 5/32-in., 34.5°, GOR 1,620 cu. ft. per bbl., TP 425 psi., perforations 2,354-45 ft. (Frio). TD 2,945 ft. (Discovery well West Ross field—½ mile west of North Ross gas field.)

Wood Brothers & Langham 5 Domingo L. Garza, Tract 144, Porcion 85. IPP 57.75 BOPD, 30°, perforations 2,188-95 ft. (Frio). TD 2,788 ft. (New pay in West Ross field.)

Webb County: Armstrong & Horn and Gilbert Brown 1 Abel, Survey 720 (2½ miles north of Oilton). IPP 12.74 BOPD, 50°, perforations 2,324-29 ft. (Yegua). TD 2,330 ft. (New field discovery—East Laurel.)

The Texas Co. 1 Albert Martin Trustee, Block 5, Myrtle E. Hald Subd., Heirs of Mariano Arispe Grant, A-850 (2½ miles east of Bruni). Absolute open-flow potential 15,500 M.c.f. daily, dry gas, shut-in TP 718 psi., perforations 2,326-36 ft. (Mirando). TD 6,808 ft. (New pay in Bruni field.)

Wilson County: Bowman Cattle Co. et al 1 Blake, Heirs of S. & J. de Arocha Grant, A-1 (3½ miles northeast of Floresville). IPP 9.8 BOPD (net), 97% water, 24°, perforations 619½-22 ft. (Reklaw). TD 622 ft. (New field.)

Zavala County: Norton Oil Co. and V. P. Grace 6 R. W. Norton, Jr., Section 48, Block 12, I&GN, Sur., A-440 (17 miles northwest of Crystal City). IP 1,100 M.c.f. daily, ¼-in., TP 710 psi., perforations 2,385-97 ft. and 2,401-09 ft. (San Miguel). TD 3,389 ft. (New field—3 miles northwest of High Lonesome gas field.)

Norton Oil Co. and V. P. Grace 7 R. W. Norton, Jr., Section 90, Block 12, I&GN Sur., A-481 (17 miles northwest of Crystal City). Shut-in gas well, flowed 440 M.c.f. daily, ¼-in., TP 310 psi., perforations 2,536-44 ft. and 2,572-80 ft. (San Miguel). TD 3,513 ft. (New gas discovery 3 miles northwest of High Lonesome field and 1½ miles southwest of Norton's new gas discovery in Section 48.)

CALIFORNIA

San Benito County: Intex Oil Co. 2 Cedar Flat-USL, NW NW 35-16s-11e, 52 BOPD, 0.1% cut, perfs. 1,180-1,210 ft., TD 2,662 ft. (New pool discovery in Cedar Flats area of Vallecitos field).

Kern County: Shell Oil Co. 84-23 KCL, SE NE 23-30s-25e, 473 BOPD, 1.4% cut, 24/64-in. choke, 75 M.c.f.d., perfs. 8,104-8,235 ft., TD 9,912 ft. (New pool discovery in northwest area of Ten Sections field).

Reserve Oil & Gas Co. 385-19 R-S-T, NE SE 19-11n-19w, 622 BOPD, 18/64-in. choke, 38.2° gravity, 0.3% cut, 414 M.c.f.d., perfs. 7,337-7,485 ft., TD 7,592 ft. (New pool discovery ¾ mile south of the main Butler-Wehr area of North Tejon field).

A **VETERAN** in the industry, Ed Parkes can see . . .

No Slowdown for Natural Gas

THE NATURAL-GAS industry will keep on growing, despite obstacles in the form of federal court rulings.

That optimistic view belongs to Ed Parkes, Shreveport, new president of United Gas Corp.

Parkes is well versed in the complexities of the natural-gas business, having served United Gas and its subsidiaries for more than 30 years. He is equally aware of the problems facing the production and pipeline segments of the industry as a result of recent decisions of the federal courts and rulings by the Federal Power Commission.

"I am not pessimistic about our industry's problems," he says. "The ingenuity and know-how that have built the oil industry, and that have brought the natural-gas industry in recent years to its present position as the sixth largest business in our country, are not suddenly going to play out.

"We confidently look for continued expansion and growth of the natural-gas industry in the years ahead. As new industries come to the Gulf South, where our company operates, and older industries continue to grow, there is every reason to be optimistic about the outlook. The total construction and development budget for our company for 1958 amounts to nearly $66 million."

Parkes' optimism is reflected in his own company's expansion program. This includes:

. . . **Current** $4½-million construction by United Gas Pipe Line Co., transmission subsidiary, to connect 13 new fields in Southeast Louisiana.

. . . **Enlargement** of delivery facilities to the San Antonio and Austin Tex., area at an estimated cost of $2½ million.

. . . **Construction** of facilities that will cost approximately $1.8 million to supply gas to several power plants and to new industrial areas near Pascagoula, Miss.

. . . **Plans to construct** soon the first leg of a 30-in. pipeline from the producing areas of South Louisiana to Mobile. This line will serve the industrial areas of Mississippi, Alabama, and Northwest Florida. It will cost an estimated $36½ million, with $18½ million of that to be spent in 1958.

Background . . . The 53-year-old Parkes has wide experience in gas production as well as in transmission line operations. He is also president of United Gas Pipe Line Co. and Union Producing Co. He was executive vice president of United Gas Corp. from November, 1955, to June, 1958.

In the 8 years preceding, he was vice president of the pipeline company, with gas supply being his major responsibility. This was the period—1947 to 1955—when new pipelines were being constructed all over the country and competition for gas in the field reached its all-time peak.

Parkes acquired tremendous

▶ ▶ ▶ Personals

P. C. Staats, reservoir engineer with Phillips Petroleum Co., has been transferred to Cortez, Colo., from Hobbs, N. M.

Donald Ricks, gang pusher for General American Oil Co., has been promoted to production foreman and transferred to Fairfield, Ill., from Turnertown, Tex.

Wilbur A. Yeager, Jr., formerly production engineer and reservoir engineer with Pan American Petroleum Corp. in Midland, Tex., has joined the First National Bank of Midland as petroleum engineer in the oil-loan department.

Don Hibbard is taking charge of the Maracaibo office of The Texas Co. where he will keep track of the company's new acreage in Lake Maracaibo. He was with Seaboard Oil Co. in Venezuela until its merger with The Texas Co.

Len (Rix) Rickard has been named western division geologist in Venezuela by Phillips Petroleum Co., with offices at Caracas. Other personnel in the division to be located at Maracaibo include **Don Gardner** and two new arrivals from Bartlesville, Okla.; **Art Ball,** district geologist, and **Bill Foster. Jim Heydrick,** also of Bartlesville, will head the eastern division geological office at Caracas. **Don Milligan** will be staff geologist.

Vernon L. Linton, Jr., division engineer for Phillips Pipe Line Co., has been transferred to Oklahoma City from Thrall, Kans.

R. H. Hurd, mechanical engineer in Shell Oil Co.'s Corpus Christi, Tex., division, has been named transport manager for Shell's Houston area. He succeeds **A. H. Gardenhire,** who recently retired.

Dr. Arthur S. Gow, Jr., formerly with United States Steel, has joined M. W. Kellogg Co. as research chemist at the company's Jersey City research and development laboratory. **Dr. John W. Kraus** joins Kellogg as research chemist from Argonne National Laboratories.

amounts of gas for his company, which today owns or holds purchase contracts on more than 11% of the known reserves of the nation.

Born in Bessemer, Ala., Parkes was graduated from the University of Arkansas with a degree in mechanical engineering.

Shortly after graduation he joined a company which later became a part of United Gas. He was assistant superintendent and district superintendent in Bastrop and Monroe, La., for 3 years, then moved to the company's general offices, in Houston at that time, as assistant to the production superintendent.

Three years later he became assistant general superintendent of pipelines, and in 1937 became general superintendent of field pipelines, a position he held for 10 years.

He is an avid "do-it-yourselfer," and his major relaxation is in doing things mechanical with his hands. At 15 he had his own Model T "hot rod," which he built himself. He likes nothing better than to don a pair of overalls to overhaul a lawn mower, tune up his car, or tinker with his TV, radio, or hi-fi.

Parkes is a director of the American Petroleum Institute, American Gas Association, Escambia Chemical Corp., Duval Sulphur & Potash Co., and Atlas Processing Co., and is chairman of the AGA committee on natural gas reserves. He is a trustee of Randolph-Macon Woman's college and a member of the Shreveport Club, the Shreveport Country Club, and the Boston Club of New Orleans.

He is married to the former Alice Washburn, of Monroe, La. They have two daughters, Mrs. Paul A. Winder, of Ann Arbor, Mich., and Miss Ruth Parkes, of Shreveport.

J. R. Bowden has been promoted to senior chemical engineer in Continental Oil Co.'s petrochemical research division.

W. W. Hanneman, who recently received a doctor's degree from the University of Nebraska, has joined California Research Corp. as research chemist in Richmond, Calif.

J. Edward Green, district geologist at Ardmore, Okla., for Sun Oil Co., has been named southern Oklahoma regional geologist. He will headquarter in Tulsa. **Richard L. Rison,** geologist at Ardmore, moves up to regional geologist there, succeeding Green. The appointments are effective September 1.

Stanley D. Brasel, seismologist party chief for Shell Oil Co. in Riverton, Wyo., has been named geophysicist in the Casper, Wyo., division.

Lowell L. Elder and **Robert S. Ryan** have been named supervisory engineers for Columbia Gas System Service Corp. **Robert R. Wright** and **Robert M. Forrest** have been named assistant senior engineers.

Joe M. Wolfe, Tennessee Gas Transmission Co.'s district exploration manager in Casper, Wyo., has been promoted to assistant Rocky Mountain division exploration manager in Denver. **Carl E. Jenkins,** Casper district geologist, will succeed Wolfe as district exploration manager there.

Loy M. Charter, formerly division development engineer for Shell Oil Co. at Bakersfield, Calif., has been transferred to Shell Development Co. in Houston. Also going to Houston is **William K. Godfrey,** formerly mechanical engineer in the Los Angeles area office.

George R. Lester, who recently received a doctor's degree in physical chemistry at the University of Kentucky, has joined Universal Oil Products Co., Des Plaines, Ill., as research chemist.

C. A. Day, manager of research and development for Richfield Oil Corp., has been named manager of the company's new petrochemical department. **L. M. Richards,** assistant manager of research and development, has moved up to manager succeeding Day. **C. D. Thurmond,** head of market research at the company's Anaheim, Calif., research center, has also been moved to the new petrochem

RICHARDS

DAY

department. Day joined Richfield in 1934 and has served as head of research and development for the past 3 years. Richards has been with the company since 1955. He was assistant director of research in physical and biological sciences at Stanford Research Institute before that time. Thurmond joined Richfield from West Coast Chemicals & Solvents, where he was vice president and secretary.

▶ ▶ ▶ Personals

MILZ

E. A. Milz, division exploitation engineer in Centralia, Ill., for Shell Oil Co., has been transferred to Tulsa as senior exploitation engineer. **J. R. Patterson,** exploitation engineer in Oklahoma City, will succeed Milz in Centralia. **K. M. Walker,** exploitation engineer in Centralia, has been named production geologist in the company's Wichita Falls, Tex., production office **F. R. Mitchell,** formerly exploitation engineer in Houston, has moved to Centralia in the same capacity. **M. E. Kiel** has been transferred from Houston to Tulsa as exploitation engineer.

Robert C. Gunness, executive vice president of Standard Oil Co. (Ind.), has been elected to the board of trustees of the University of Chicago. Gunness is a graduate of the University of Massachusetts and Massachusetts Institute of Technology.

N. R. Legge has been named assistant head of Shell Development Co.'s polymer and chemical applications department. **R. J. Reynolds** has been named research supervisor in the department.

Gerald McGrew, manager of Cities Service Oil Co.'s crude-oil supply division, has been named coordinator of transportation and supply. He will be in charge of movements of crude, refining products, and light ends, and will coordinate activities of the planning and economics department and pipeline, crude-oil purchases and sales, and supply and distribution divisions.

Don S. Warning, manager of the distribution economics department for Standard Oil Co. (Ind.), has taken over responsibilities of **John W. Boatwright,** chief economist. Boatwright is now on special assignment involving Indiana Standard's foreign activities. In other changes, **William L. Leavitt,** director of the commercial research division, economics department, has been appointed commercial research associate. **Blaine M. Cooke,** formerly director of the marketing economics division, becomes director of the new commercial research division, which combines the former marketing economics and commercial research divisions. **Henry J. Hart** has been appointed supervisor of the marketing economics section, a new position.

Jurenev

Hinson

Cosgrove

Continental Names Two Board Members

Serge B. Jurenev and Howard H. Hinson were elected to the board of directors of Continental Oil Co. last week following resignation of two of the company's top executives.

Leaving the board are James J. Cosgrove, chairman, and E. F. Battson, vice president and chairman of the executive committee. Cosgrove, 71 years old, and Battson, 65, are both of New York.

L. F. McCollum, president, will continue as chief executive officer of the company.

Jurenev, who is in Conoco's New York office, is assistant to the president and chief economist. Hinson, of Houston, is vice president and general manager of the foreign department.

Jurenev was associated with J. P. Morgan & Co. and the Department of Justice before joining Conoco in 1942. He became secretary and assistant treasurer of the company in 1944 and treasurer in 1948.

He was head of the coordinating and planning department in Houston from 1949 and 1953. He assumed his present post in 1956.

Hinson joined Continental in 1948 as chief production research engineer at Ponca City, Okla. He previously was with the U. S. Bureau of Mines. He had been assistant manager of Continental's production department at Houston, southwestern regional general manager in Fort Worth, and vice president in charge of exploration in Houston before being named to his present post last year.

Cosgrove, retiring chairman, joined Conoco as general counsel in 1929. He was elected a vice president in 1944 and chairman of the board 2 years later. He retired partially in 1952.

Battson's retirement as vice president and chairman of the executive committee was announced earlier this month (OGJ, Aug. 4, p. 148).

George H. Murray, Jr., has resigned as geologist with Carter Oil Co. in Miles City, Mont., to open consulting offices in Billings, Mont.

Donald H. Randall, exploitation engineer in Shell Oil Co.'s Billings, Mont., division, has been named reservoir engineer there. **Jack A. Bale,** mechanical engineer in Billings, has been transferred to Denver in the same capacity.

Joseph Andreae, formerly assistant to the management of Esso Shipping Co., and **Robert W. Mountrey,** vice president and a director of Esso Shipping, have been elected vice presidents of Esso Tankers, Inc. **Edwin L. Stewart,** former vice president and a director of Esso Shipping, has been named special assistant to the president of Esso Tankers, a new Jersey Standard subsidiary. Esso Shipping recently became a part of Esso Standard Oil Co.

Bruce Brooks, geologist with Superior Oil Co., has been transferred to Casper, Wyo., from Bakersfield, Calif.

A. B. Crowther, Jr., petroleum engineer with Humble Oil & Refining Co., has been transferred to Houston from Snyder, Tex. Crowther joined Humble in Midland earlier this year.

W. L. Kreps and **C. P. Peterman** have been transferred by Shell Oil Co. from Houston to Tulsa as mechanical engineers. **R. M. Clawson,** mechanical engineer, has been transferred from Houston to Wichita Falls, Tex.

C. M. Oktay, formerly at Phillips Petroleum Co.'s Philtex petrochemical plant, Phillips, Tex., has been transferred to the research and development department in Bartlesville, Okla., as a theoretical development engineer.

Earle W. Lewis, assistant to the manager of The Texas Co.'s West Texas division, Fort Worth, has retired. Lewis joined Texaco in 1914.

W. J. Holt, district foreman for Interstate Oil Pipe Line Co., has been transferred to Powell, Wyo., from Magnolia, Ark.

Wesley J. Burris, formerly a student at the University of Tulsa, has joined Sinclair Oil & Gas Co. in Bairoil, Wyo., as production engineer.

Ted Gupton, who recently retired as district sales manager in Houston for Alco Products, Inc., has joined Pipe Line Technologists, Inc., Houston, as management engineer.

R. D. Tooley has joined California Research Corp.'s La Habra, Calif., research center as research physicist. **H. C. Mitchell** has joined the company at La Habra as research engineer in reservoir mechanics.

When the headquarters of Penrod Drilling Co. are moved from Shreveport to Dallas on September 1, four members of the operating staff will join in the move. They are **Jack Johnson,** drilling superintendent, **Fred Staggs,** division drilling superintendent, **Bill McDonald,** assistant division drilling superintendent, and **Ned Simes,** safety director.

BARRE

C. H. Barre has been named refinery manager at Texas City for Republic Oil Refining Co. Barre joined Republic in 1946 and has served as chief chemist and more recently as coordinator of manufacturing. He succeeds **L. W. Robbie,** who resigned August 29 as vice president and general manager of Republic and vice president of Plymouth Pipeline Co.

Bill Dowling, head of the chemical productions division at Esso Standard Oil Co.'s Bayonne, N. J., refinery, has been transferred to Esso Export Corp., where he will work with coordination of chemical products activities. **Fred Moulton,** head of plant maintenance and construction, has been named head of chemical products, succeeding Dowling. **Frank Kadlubowski,** shift superintendent, will succeed Moulton, and **Al Sharke,** supervisor in the plant shops division, will replace Kadlubowski.

Robert E. Collins, assistant chief process engineer for Neches Butane Products Co., Port Neches, Tex., has moved up to chief process engineer. **Nicholas J. Vaglica** has succeeded Collins as assistant chief process engineer. A graduate of Texas A & M College and the University of Okla-

COLLINS

VAGLICA

homa, Collins was transferred to Neches Butane Products from The Texas Co. in 1943. Vaglica, a graduate of Texas A & M, has been on special assignment in Houston and New York working with expansion plans for the Neches plant. He joined the company in 1943.

George A. Hemenway, assistant division geologist in Denver for Sinclair Oil & Gas Co., has been promoted to division geologist. He succeeds **Joseph W. Jackson, Jr.,** who was recently promoted to division exploration superintendent.

Ronald S. Ritchie, manager of the British Columbia marketing division of Imperial Oil, Ltd., has been promoted to assistant general manager of marketing. He succeeds **Harold L. Magee,** who has retired. **Howard W. Coxon,** operations manager of the marketing department in Toronto, will succeed Ritchie. **Harvey B. McGonigal,** coordinator of retail development, moves up to replace Coxon.

Russell D. Richardson has been named vice president, finance, for Tidewater Oil Co. He will continue as treasurer and controller.

Dr. L. H. Sutherland, section head in Escambia Chemical Corp.'s research department, has been appointed assistant director of research. He will continue to headquarter in Escambia's Wilton, Conn., research center.

R. M. Bartlett, vice president in charge of foreign crude-oil sales for Gulf Oil Corp., will retire September 1. Bartlett joined Gulf in 1926. He had served as vice president in charge of fuel-oil sales for Gulf Oil and Gulf Refining Co. and vice president in charge of general sales before being named head of foreign crude-oil sales.

Charles A. Cone, a former vice president of Dresser Engineering Co., Tulsa, has been elected president of Oil States Engineering Co., recently organized Tulsa company. **W. G. Storey,** former vice president of Trend Construction Co., is vice president of the new company. **A. C. Young,** former chief mechanical engineer for Dresser Engineering, is secretary-treasurer of Oil States.

K. J. Kitzmiller, manager of the aromatics department at Shell Oil Co.'s Houston refinery, has been promoted to manager of the lubricating-oils department. **C. L. Marshall,** manager of thermal cracking, will succeed Kitzmiller. **H. F. Tighe,** manager of the gas department, becomes manager of the thermal-cracking department. Tighe will be succeeded as gas-department manager by **S. F. Good,** manager of the alkylation department at Shell's Wood River, Ill., refinery.

Personals

W. S. Frisbie, formerly of Frisbie Drilling Co., Tulsa, has joined Falcon Seaboard Drilling Co. as special representative. He will be available for assignments with D & D Drilling & Construction Co., a Venezuelan subsidiary, in addition to his work with Falcon's domestic drilling activities. He will headquarter in Tulsa. Frisbie was assistant to the president of Parker Drilling Co. before organizing Frisbie & Yancey Drilling Co. and later, Frisbie Drilling.

John B. Ross, district engineer, has been transferred to Midland, Tex., from Wichita Falls, Tex., by The Texas Co.

J. W. Higgins, district geologist for Standard Oil Co. of California's exploration department in Los Angeles, has been named senior research geologist, staff, in the San Francisco office of California Research Corp.

G. S. Williamson, manager of Shell Chemical Corp.'s Pittsburg, Calif., ammonia plant, has been named manager of the company's synthetic-rubber plant at Torrance, Calif. He succeeds **Maarten Voogd,** whose retirement was announced last week. **F. G. Watson,** assistant manager of Shell Chemical's manufacturing division in New York, has been appointed manager at Pittsburg, succeeding Williamson. Williamson was plant superintendent at Torrance before becoming manager of the Pittsburg facility.

Deaths

John Sumner Armor, 84, pioneer Oklahoma drilling contractor and producer died August 14 in a Duncan, Okla., hospital.

Truman Moore, 42, south Gulf Coast representative for Technical Oil Tool Corp., and his wife, **Mary Bowman Moore,** were killed recently in an auto accident north of Mexico City. The Moores, of Alice, Tex., were on their honeymoon.

Lloyd L. Sullins, assistant district superintendent for Amerada Petroleum Corp. in Seminole, Okla., was killed recently in an auto accident near Hays, Kans.

Allison C. Neff, 1955-56 president of the National Society of Professional Engineers, died August 11 in Middletown, Ohio, after a heart attack. Neff was vice president and central division manager of Armco Drainage & Metal Products, Inc.

J. E. (Eddie) Prendergast, 31, administrative assistant to the manager of Sun Oil Co.'s southwest production division at Dallas, died August 12 in Dallas after a heart attack. Prendergast joined Sun in 1950. He was a grandson of the late J. Edgar Pew, former production vice president of Sun, and a nephew of the present production vice president and director, John W. Pew, Philadelphia.

Robert (Ace) Gruenig, 46, laboratory technician for Empire Petroleum Co. and one of Denver's greatest basketball stars, died recently of a heart attack in Del Norte, Colo. Gruenig was named to the AAU All-America cage teams 10 times between 1937 and 1948.

M. S. (Max) Kelly, 65, Oklahoma City oil lease promoter, died August 14. Kelly was with Empire Gas & Fuel Co., Bu-Vi-Bar Oil Co., and Marland Oil Co. before becoming an independent.

John C. Watkins, 64, office manager for Forest Oil Co. in Nowata, Okla., died August 13 in Nowata.

Completion rate starts to climb

BY JOHN C. CASPER
Economics Editor

OIL OPERATORS will have to complete wells at the rate of a little more than a thousand a week for the rest of the year to reach the total indicated by their plans at midyear. They completed 1,050 wells per week in the same period last year.

Total wells for the week ended August 16 numbered 986 or about 20 wells short of the average needed for the remainder of the year.

The drilling pattern for the past 2 years has been very irregular. Last year the well-completion total for the first quarter was good, compared with the average for the 1950-56 period. For the 7 years, drilling in the first quarter accounted for about 23.8% of the total for the average year. If drilling last year had continued at the rate indicated by completions in the first quarter, total wells for the year would have been almost 56,000. The final figure was 53,838 wells.

Completions dropped below the 1950-56 average in June and early July last year but climbed above 1,100 wells per week in August. The general average remained above 1,100 wells per week until the end of October. The high completion rate in this period last year will continue to show up in the comparison of cumulative completions in 1958 with corresponding data in 1957.

Total completions this year through August 16 amounted to 29,343 wells, down 4,033 from the total for the same period last year. The spread between the cumulative totals for the 2 years will continue to grow until some time early in November but will decrease during the last 2 months of the year.

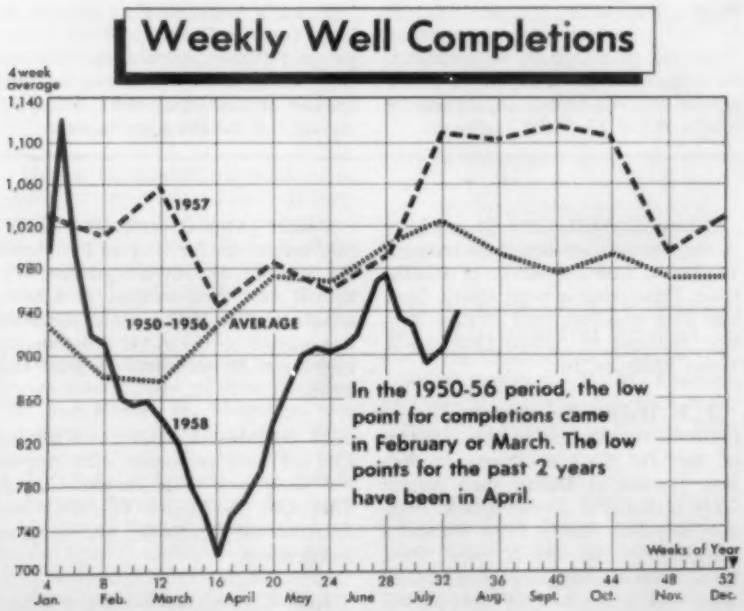
There has been a definite upturn in drilling since the middle of July. Operators reported 855 completions for the week ended July 19. There has been an increase each week since that date, and data on rotary rigs point to continuing gains.

Rotary rigs operating in the United States, reported by Hughes Tool Co., have been above 1,900 for the past 2 weeks. The total was consistently below 1,900 from the middle of February to the end of July, with an average for the period of 1,802 rigs.

Since there has been good correlation between producer income and wells drilled, higher crude-production rates in the coming months will mean more wells.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,833,425	DOWN	1,650	UP	40,975
Crude stocks	249,796,000	DOWN	514,000	DOWN	36,822,000
Completions	986	UP	54	DOWN	132
Refinery runs	7,713,000	UP	116,000	DOWN	256,000
Gasoline stocks	176,487,000	DOWN	810,000	UP	4,351,000
Kerosine stocks	27,018,000	UP	712,000	DOWN	6,003,000
Distillate stocks	128,767,000	UP	3,929,000	DOWN	17,936,000
Residual stocks	67,165,000	DOWN	86,000	UP	16,242,000
Four-product stocks	399,437,000	UP	3,745,000	DOWN	3,346,000
Total imports	1,393,900	DOWN	137,700	DOWN	216,000



WELL-COMPLETION RATES have been below the 1950-56 average since early March but will cross that line in September and the 1957 line in November.

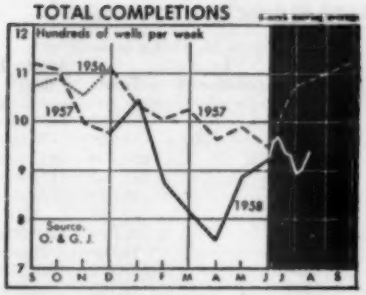
Marketers Waiting for September

Petroleum-product prices are changing a little, but actual sales are limited to current needs.

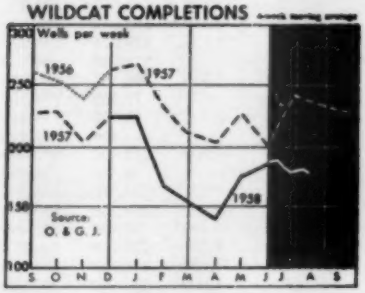
Some Group 3 refiners have raised kerosine and distillate prices, but very little movement is reported at either the old or new postings.

Gulf Coast gasoline suppliers are asking the low of the market, but spot buyers are scarce. Any refiner who has to move some gasoline before the end of this month will be very lucky if he doesn't have to shade the low by a quarter. Some Group 3 suppliers who expected to be short on gasoline in August actually have some that they would like to sell.

TOTAL COMPLETIONS



WILDCAT COMPLETIONS



Active Rotary Rigs*

	8-18-58	8-11-58	8-19-57
Alabama	6	6	3
Arkansas	23	24	25
Arizona	2	....	....
California	74	67	109
Colorado	42	42	62
Florida	1	1	1
Georgia	....	....	....
Idaho	....	....	....
Illinois	47	50	44
Indiana	8	7	9
Iowa	3	3	2
Kansas	149	141	156
Kentucky	4	11	14
Louisiana	302	298	444
North	42	42	64
South	223	216	276
Offshore	37	40	104
Maryland	....	....	1
Michigan	10	12	12
Missouri	....	1	....
Montana	24	21	25
Mississippi	44	41	39
Nebraska	25	28	25
Nevada	....	....	1
New Mexico	104	105	172
New York	1	2	....
North Dakota	30	32	26
Ohio	....	....	1
Oklahoma	207	214	268
Oregon	....	....	1
Pennsylvania	11	11	13
South Dakota	3	2	1
Texas	684	707	950
Gulf Coast	134	155	204
Offshore	1	1	3
West	280	284	381
North	219	214	303
East	50	53	59
Tennessee	....	....	1
Utah	32	29	61
Washington	1	1	1
West Virginia	5	5	5
Wyoming	68	65	79
Virginia	....	....	1
Total U. S.	1,910	1,926	2,552
Western Canada	142	143	180
Eastern Canada	2	2	3
Grand total	2,054	2,071	2,735

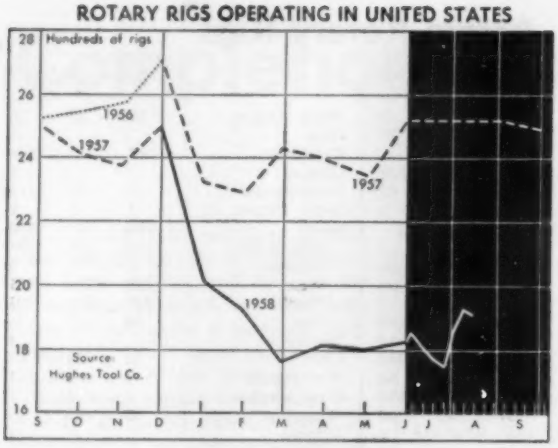
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 16, 1958

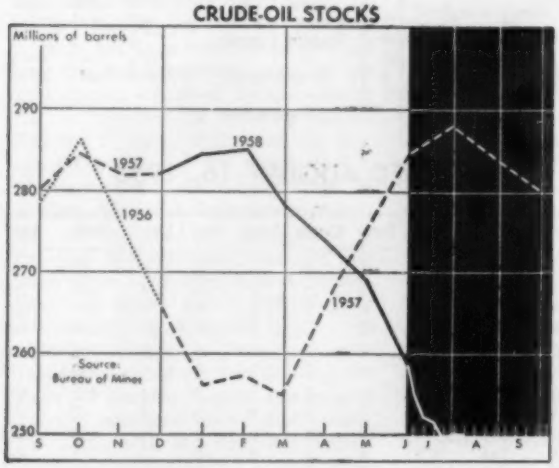
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	0	0	0	0	0	0	0	45	61	0	0	0	0	0	17	19
Arkansas	37	20	0	1	16	0	126,497	446	680	6	0	0	0	6	105	126
California	22	12	0	0	10	0	135,559	1,033	1,343	6	1	0	0	5	235	333
Colorado	26	7	0	1	18	0	142,788	498	538	17	2	0	0	15	286	363
Illinois	37	13	0	0	24	0	87,928	1,312	1,580	9	0	0	0	9	256	400
Indiana	10	6	0	0	4	0	15,272	450	388	6	2	0	0	4	169	78
Kansas	74	33	1	4	33	3	250,499	2,331	2,617	13	2	0	0	11	492	525
Kentucky	25	10	0	9	6	0	39,525	674	887	3	1	0	0	2	75	179
Louisiana	69	27	3	1	38	0	557,499	2,104	2,374	14	2	1	0	11	303	424
North	23	9	0	1	13	0	93,824	744	828	8	1	0	0	7	115	111
South	38	14	2	0	22	0	393,957	1,082	1,093	6	1	1	0	4	170	256
Offshore	8	4	1	0	3	0	69,718	278	453	0	0	0	0	0	18	57
Michigan	10	2	0	0	7	1	23,530	263	259	5	0	0	0	5	89	96
Mississippi	8	5	1	0	2	0	76,571	241	230	2	0	0	0	2	115	121
Montana	3	2	0	0	1	0	21,476	203	243	1	0	0	0	1	88	86
Nebraska	14	5	0	0	9	0	81,789	433	548	6	0	0	0	6	205	305
New Mexico	49	16	2	25	6	0	203,833	1,236	1,323	2	0	0	0	2	160	175
West	31	4	0	25	2	0	124,002	597	525	2	0	0	0	2	69	62
East	18	12	2	0	4	0	79,831	639	798	1	0	0	0	1	92	113
New York	10	5	0	0	0	5	13,500	355	288	0	0	0	0	0	32	4
North Dakota	4	2	0	0	2	0	25,010	279	172	1	0	0	0	1	92	72
Ohio	22	8	0	3	10	1	48,072	663	688	0	0	0	0	0	8	7
Oklahoma	105	58	10	6	27	4	355,572	3,979	3,889	7	0	2	0	5	557	447
Pennsylvania	50	15	0	21	5	9	143,257	360	442	0	0	0	0	0	9	39
Texas	360	196	14	20	126	4	1,424,695	11,223	13,715	62	5	1	0	56	2,277	3,396
Dist. 1	32	15	0	1	16	0	50,043	616	796	10	0	0	0	10	247	276
Dist. 2	22	6	4	4	8	0	138,740	475	488	4	0	0	0	4	124	182
Dist. 3	25	5	4	0	16	0	169,199	807	1,098	4	0	0	0	4	177	323
Dist. 4	23	9	3	1	10	0	130,935	751	884	4	1	1	0	2	218	303
East	17	9	0	0	8	0	74,676	759	812	6	0	0	0	6	213	239
Dist. 7-B	51	23	0	0	27	1	154,160	1,511	1,779	12	1	0	0	11	424	644
West	84	64	3	2	15	0	427,713	3,266	3,889	10	1	0	0	9	452	574
Dist. 9	87	58	0	1	25	3	199,672	2,266	3,051	11	1	0	0	10	360	784
Dist. 10	19	7	0	11	1	0	79,557	772	918	1	1	0	0	0	62	71
Utah	6	5	0	0	1	0	35,838	256	129	1	0	0	0	1	54	71
West Virginia	15	4	0	9	2	0	35,365	440	398	0	0	0	0	0	12	19
Wyoming	28	17	0	6	5	0	156,512	457	522	3	0	0	0	3	128	177
Misc. (Alaska, Oregon	2	0	0	0	2	0	22,140	62	62	2	0	0	0	2	54	45
Total U. S.	986	468	31	106	354	27	4,022,727	29,343	33,376	166	15	4	0	147	5,818	7,507
Total prev. wk.	932	448	18	69	374	23	3,693,197	....	....	195	20	5	12	158	....	....
Cum. 1958	29,343	14,443	718	2,239	11,202	741	122,434,528	....	....	5,818	580	99	175	4,964	....	....
Western Canada	41	24	0	5	9	3	211,774	1,517	1,937	6	0	0	1	5	425	553

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	8-9-58	8-2-58	8-10-57
Pennsylvania	2,872	2,806	3,052
Other Appalachian	1,477	1,659	1,635
Illinois, Indiana, Michigan	11,053	10,805	11,391
Nebraska and North Dakota	2,097	2,045	2,451
Kansas	9,782	9,937	10,732
Oklahoma	14,948	15,099	22,413
Arkansas	1,951	1,891	2,619
Louisiana	16,671	16,603	18,663
North	2,802	2,905	3,092
South	13,869	13,698	15,571
Mississippi, Alabama, Florida	2,265	2,349	2,609
New Mexico	6,182	6,150	8,995
Texas	101,153	102,680	127,959
East Texas	7,259	7,013	10,670
West Texas	49,136	50,233	61,792
Texas Gulf	19,351	19,832	23,646
Other Texas	25,407	25,602	31,851
Wyoming	14,604	14,666	17,817
Other Rocky Mountain	9,725	9,798	6,419
California	37,940	37,266	30,244
Foreign	†17,076	16,556	17,373
Total	249,796	250,310	284,372

*Bureau of Mines. †Includes 5,527,000 bbl. in California.

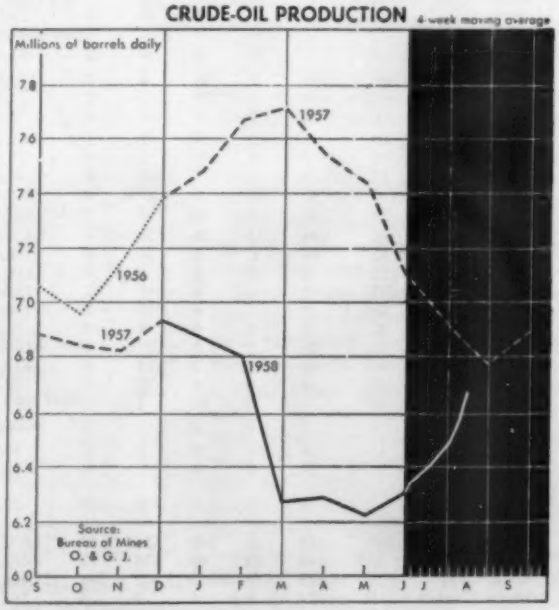
DAILY AVERAGE PRODUCTION FOR WEEK

	August 16, 1958			August 9
	Crude oil	Lease condensate	Total	total
Alabama	17,050	.....	17,050	17,100
Arkansas	74,325	200	74,525	74,600
California	850,800	.....	850,800	852,300
Colorado	132,500	.....	132,500	134,000
Eastern	46,800	.....	46,800	47,000
Florida	1,275	.....	1,275	1,275
Illinois	226,000	.....	226,000	230,900
Indiana	31,800	.....	31,800	31,100
Kansas	†329,375	.....	†329,375	†322,500
Kentucky	41,700	.....	41,700	41,900
Louisiana	761,550	81,525	843,075	843,075
North	102,050	2,000	104,050	104,050
South	659,500	79,525	739,025	739,025
Michigan	25,200	.....	25,200	24,700
Mississippi	96,600	3,950	100,550	100,550
Montana	77,800	.....	77,800	78,300
Nebraska	57,100	.....	57,100	56,800
Nevada	100	.....	100	100
New Mexico	272,400	5,000	277,400	277,400
North Dakota	34,500	.....	34,500	36,400
Oklahoma	†554,700	.....	†554,700	†556,100
Texas	2,627,000	62,100	2,689,100	2,689,100
Dist. 1	45,000	400	45,400	45,400
Dist. 2	116,000	8,200	124,200	124,200
Dist. 3	345,000	31,000	376,000	376,000
Dist. 4	192,000	8,000	200,000	200,000
Dist. 5	32,000	275	32,275	32,275
Dist. 6	117,000	6,000	123,000	123,000
East Texas Field	153,000	.....	153,000	153,000
Dist. 7-B	142,000	75	142,075	142,075
Dist. 7-C	131,000	4,050	135,050	135,050
Dist. 8	1,045,000	1,800	1,046,800	1,046,800
Dist. 9	204,000	1,500	205,500	205,500
Dist. 10	105,000	800	105,800	105,800
Utah	95,600	.....	95,600	94,000
Wyoming	326,300	.....	326,300	325,700
Others	‡175	.....	‡175	‡175
Total U. S.	6,680,650	152,725	**6,833,425**	6,835,075
Change from prev. week, down			**1,650**	
Canada	†440,900	.....	†440,900	†448,600

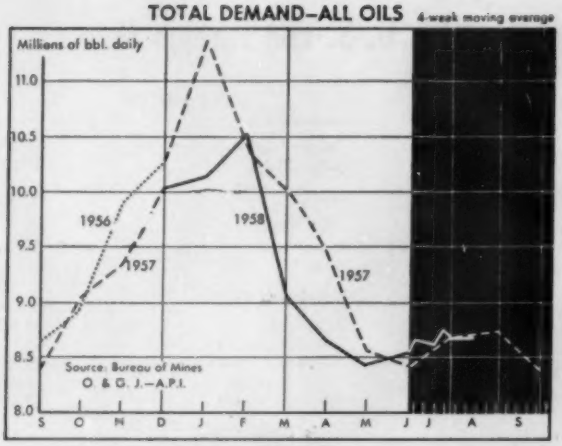
Total U. S. production—Jan. 1,-Aug. 16 ..... 1,478,157,600 bbl.
Same period last year (crude plus cond.) ..... *1,677,330,039 bbl.

*Includes 32,055,225 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Washington.

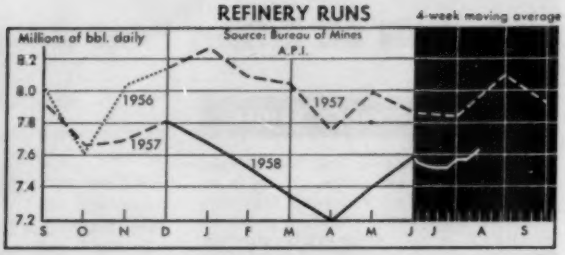
CRUDE-OIL PRODUCTION 4-week moving average



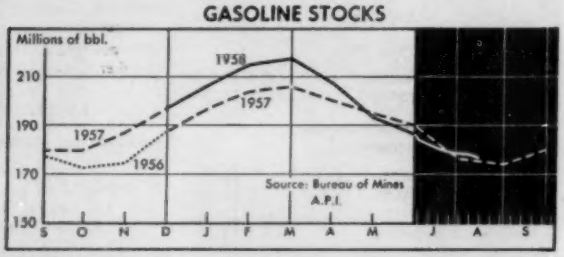
TOTAL DEMAND—ALL OILS 4-week moving average



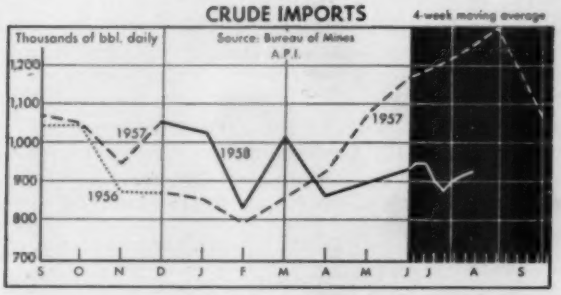
REFINERY RUNS 4-week moving average



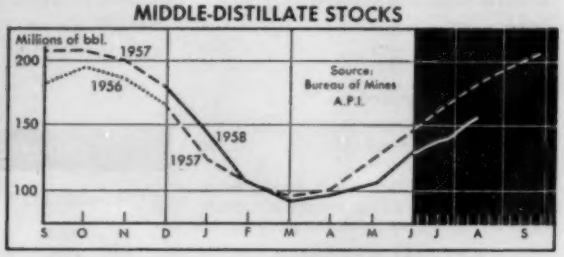
GASOLINE STOCKS



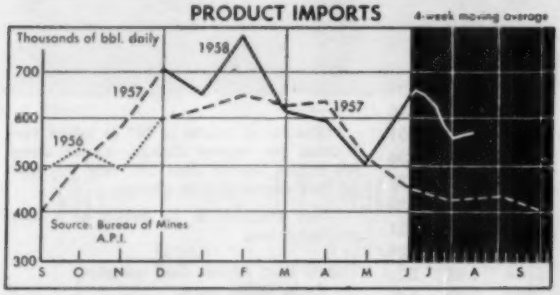
CRUDE IMPORTS 4-week moving average



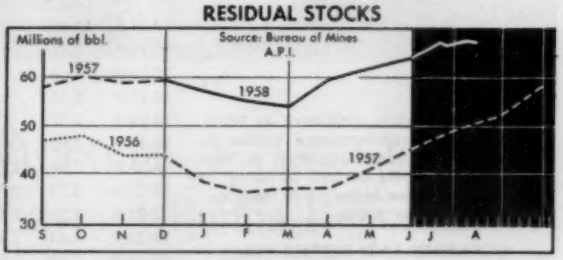
MIDDLE-DISTILLATE STOCKS



PRODUCT IMPORTS 4-week moving average



RESIDUAL STOCKS



API REFINERY REPORT—AUGUST 15, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, August 1957 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist	Resid.
East Coast ...	1,119	522.0	33.4	272.3	201.6	40,600	9,631	43,149	12,877	1,283	530.9	22.0	334.6	237.7
Appalachian:														
Dist. 1	91	41.6	2.9	22.1	5.6	4,533	528	2,778	492	98	44.7	3.4	21.9	5.4
Dist. 2	102	59.3	6.0	21.9	9.7	2,385	528	1,212	317	68	37.0	2.3	10.3	8.1
Ind., Ill., Ky. ...	1,346	726.0	41.2	291.0	115.6	33,570	6,665	22,837	5,551	1,332	694.9	52.2	263.3	135.8
Minn., Wis., Dak.	117	55.8	3.6	30.4	15.3	6,740	1,482	7,071	599	105	50.1	7.5	26.7	8.1
Okla., Kans., Mo.	770	428.6	12.4	183.9	24.3	17,000	1,602	12,582	1,022	744	419.0	14.7	165.0	28.2
Inland Texas ..	261	180.6	8.0	49.3	13.8	6,516	376	1,953	1,961	286	210.6	8.0	52.8	21.3
Tex. Gulf Coast	1,750	864.1	93.0	422.0	192.0	22,349	2,707	13,399	8,403	1,917	990.5	92.7	505.2	231.2
La. Gulf Coast	646	379.3	63.7	134.6	49.6	8,998	1,855	5,244	1,493	656	358.3	33.6	168.1	45.4
N. La. and Ark.	100	40.8	7.4	22.1	7.6	4,571	961	2,029	168	91	32.2	5.3	19.2	6.8
Rocky Mtn.:														
New Mexico	16	12.4	.....	3.3	0.8	315	11	110	50	28	14.9	0.3	4.9	3.7
Other Rky. Mt.	277	135.4	1.4	58.1	35.0	5,051	281	3,027	938	292	141.3	4.2	63.2	36.6
West Coast ...	1,118	493.7	5.6	150.1	314.4	23,859	391	13,376	33,294	1,192	517.1	5.5	170.6	320.5
Aug. 15, 1958	7,713	3,939.6	278.6	1,661.1	985.3	176,487	27,018	128,767	67,165	8,092	4,041.5	251.7	1,805.8	1,088.8
Aug. 8, 1958	7,597	3,941.3	220.7	1,675.7	948.7	177,297	26,306	124,838	67,251	.....	.....	.....	.....	.....
Aug. 16, 1957	7,969	3,894.4	264.6	1,775.0	1,120.4	172,136	33,021	146,703	50,923	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (89 octane)	11.875-12.25
Premium (99 octane)	14.875-15.25

Gulf Coast (cargoes for coastwise or export movements):

Regular (90 octane)	10.75
Regular (92 octane)	11.00
Premium (97 octane)	12.00-12.125
Premium (98 octane)	12.125-12.25

California (rack) (Los Angeles):

Regular (88 octane)	11.3-11.5
Premium (96 octane)	12.8-13.0
Premium (98 octane)	13.3-13.5

Caribbean area (cargoes):

Regular (87 octane)	10.375
Premium (97 octane)	12.125

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

★ Kerosine 42-44	9.50-10.00
★ Diesel oil (58 d.i. and above)	9.25-9.75
★ Distillate No. 1	9.25-9.75
★ Distillate No. 2	8.50-9.00

Gulf Coast (cargoes):

Kerosine 41-43	8.875
Distillate No. 2	8.625

New York Harbor (barges):

Kerosine 41-43	9.95
Distillate No. 2	9.45
Diesel fuel, 48-52 d.i.	10.05

Caribbean area (cargoes):

Distillate No. 2	8.625

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank car	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.30-1.35
Gulf Coast (cargoes):	
Bunker C fuel	$2.20-2.25
New York Harbor (barges):	
Bunker C fuel	$2.57
Caribbean (cargoes):	
Bunker C	$2.25
California (rack):	
Bunker C fuel, Los Angeles	$2.45

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.§	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.36	....	....	....	....
15-15.9	2.41	....	....	....	$1.81
16-16.9	2.46	....	....	....	1.86
17-17.9	2.51	....	....	....	1.91
18-18.9	2.57	....	....	....	1.96
19-19.9	2.62	....	....	....	2.01
20-20.9	2.68	$2.75	....	$2.62	2.06
21-21.9	2.73	2.77	....	2.64	2.11
22-22.9	2.78	2.79	....	2.66	2.16
23-23.9	2.84	2.81	$3.44	2.68	2.21
24-24.9	2.89	2.83	3.46	2.70	2.26
25-25.9	2.95	2.85	3.48	2.72	2.31
26-26.9	3.00	2.87	3.50	2.74	2.36
27-27.9	3.06	2.89	3.52	2.76	2.49
28-28.9	3.11	2.91	3.54	2.78	2.54
29-29.9	3.16	2.93	3.56	2.80	2.59
30-30.9	3.22	2.95	....	2.82	2.63
31-31.9	3.27	2.97	....	2.84	2.67
32-32.9	3.33	2.99	....	2.86	2.71
33-33.9	3.38	3.01	....	2.88	2.75
34-34.9	3.44	3.03	....	2.90	2.79
35-35.9	....	3.05	....	2.92	2.83
36-36.9	....	3.07	....	2.94	2.87
37-37.9	....	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40-44.9	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, West Texas (sweet). †Low cold test crude. ‡Sour. §Some postings 3-11 cents lower.

Effective dates of broad changes: California, 6-22-58; east of California, January 3-10, 1957; Pennsylvania Grade, 6-18-58.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	3.90
Middle District	3.72
Southwest Pennsylvania	3.43
West Virginia	3.25
Buckeye Grade	3.25
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.30
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25
Bachaquero, flat, 15°-16°, Las Piedras*	2.08

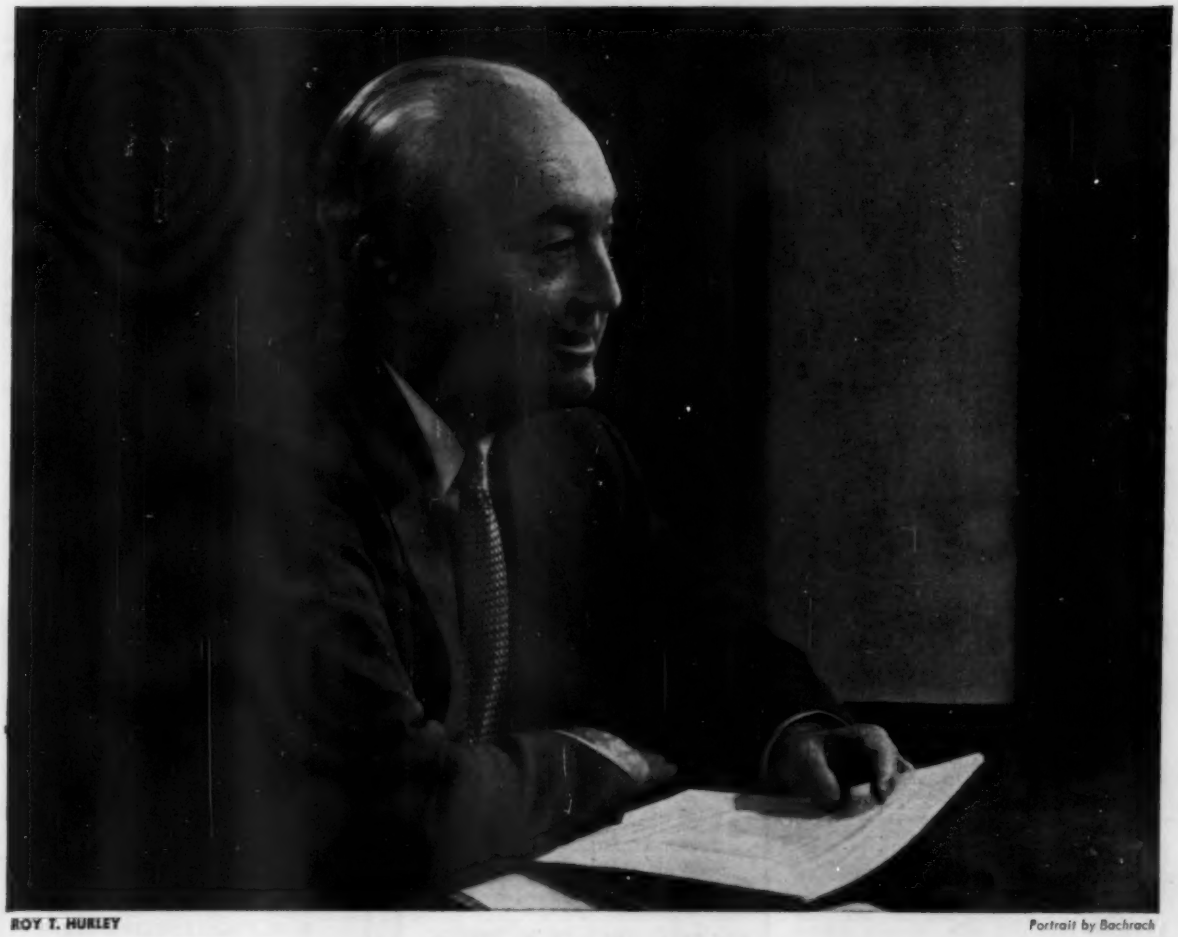
Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON
(Latest reported spot fixtures)

★ Carib.-Canada, clean (USMC —37.5%)	$2.53
★ Carib.-U.S.N.H., dirty (USMC —42.5%)	1.55
★ P.G.-U.K., clean (USMC—40%)	6.54
★ Sidon-U.S.N.H., dirty (USMC —60%)	3.12



ROY T. HURLEY

Portrait by Bachrach

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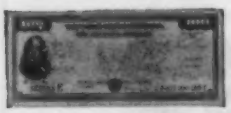

The Oil and Gas Journal

Tulsa 1, Oklahoma

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U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Pursuant to the provisions of Public Land Order 1621 dated April 18, 1958, notice is hereby given that approximately 16,000 acres of land situated on the Gubik gas field, Alaska, lying north of the Brooks Mountain Range are being offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 P. M., E.D.T., on September 3, 1958. This acreage will be offered in separate parcels of designated leasing blocks not exceeding 640 acres as shown on the leasing map of the Gubik gas field. This map of the Gubik gas field, as well as maps of the surrounding lands which are subject to noncompetitive leasing, is contained in a map portfolio which will be available for examination or purchase at $1.50 per portfolio at the Land Offices, Anchorage and Fairbanks, Alaska, and at the Bureau of Land Management, Interior Building, Washington 25, D. C. Details of the lease offer, how and where to submit bids may be obtained from either of the offices named. (Edward Woozley, Director, Bureau of Land Management, Washington 25, D. C.)

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 3,196.77 acres of land in 39 parcels within the known geologic structures of a number of fields in Big Horn, Park, and Weston Counties, Wyoming, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre **through sealed bids** on or before September 17, 1958, when bids will be opened. Details of the lease offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Craig A. Decker, Manager.

ADVERTISERS
in this issue

A

Allis Co., The Louis 130
Aluminum Co. of America 24, 25
American Chain Division of American Chain & Cable 142
American Iron & Machine Works Co.— Back Cover
American Steel & Wire Division 23

B

Baker Oil Tools, Inc. 38
Beech Aircraft Corporation 36
Bethlehem Steel Company 28, 29
British Petroleum Company, Limited, The 58

C

Cameron Iron Works, Inc. 88, 89
Chicago Bridge & Iron Company 57
Classified Advertising 158, 159, 160
Colorado Fuel and Iron Corp. 13

D

Dallas Manufacturing Co. 140
Darling Valve & Manufacturing Co. 35
Denver National Bank, The 140
DeZurik Corporation 121
Dowell 134, 135
Drilling & Service, Inc. 141
Duff-Norton Company 31

E

Engineered Oil Tools, Inc. 84

F

First National Bank & Trust Co. of Tulsa, The 32
Fluor Corporation, Ltd., The 8
Foxboro Company, The 93
Franks Division of Cabot Shops, Inc., Inside Back Cover

G

Goodrich Industrial Products Co., B. F. 5
Goulds Pumps, Inc. 111
Grove Valve and Regulator Company 9
Gulberson Corporation 7

H

Halliburton Oil Well Cementing Co. 104, 105
Homco 11

I

Industrial Supply Company 106
International Nickel Company, Inc., The 40

J

Japan Steel & Tube Corporation 108
Johnston & Jennings Company, The, Division of Pettibone Mulliken Corporation 121
Jones & Laughlin Supply Division 98, 99

L

Lane-Wells Company ..... Inside Front Cover
Lapeer Manufacturing Co. 33
Leland Equipment Co. 139
LeTourneau, Inc., R. G. 10
Levingston Shipbuilding Company 106
Liberty National Bank & Trust Co. 129
Lone Star Steel Company 61

M

M & V Tank Company 142
McKissick Products Corporation 109
Mid-Continent Supply Company 16
Mission Mfg. Company 21
Motorola Communications & Electronics, Inc. 15

N

National Bank of Commerce, The 12
National Tank Company 162
National Tube Division 81
Nelson Electric Mfg. Co. 126
Nippon Kokan KK. 108
Norris Manufacturer, Inc., W. C. 4

O

Oil Well Supply Division 6
Oliver Corporation, The 1

P

Paris Distributor, Inc., Henry H. 120
Parkersburg Rig & Reel Co. 96
Petroleum Electric Power Assn. 101
Petroleum Engineering & Tool Co. 129
Petroleum Equipment Suppliers Association 14
Plastic Applicators, Inc. 22
Pulsation Controls Corporation 27

R

Refinery Supply Co., The 119
Ryerson & Son, Inc., Joseph T. 138

S

Struthers Wells Corporation 30

T

Thermoid Company 137
Thomas Flexible Coupling Co. 125
Thornhill-Craver Co. 17
Triangle Valve Co., Ltd. 114

U

United States Rubber Company 26
United States Steel Corporation— American Steel & Wire Division 23
National Tube Division 81
Oil Well Supply Division 6
United States Treasury Dept. 157

V

Victaulic Co. of America 34
Visco Products Co., Inc. 64
Vogt Machine Co., Henry 20

W

Waukesha Motor Company 18, 19

Y

Youngstown Sheet and Tube Company 112, 113

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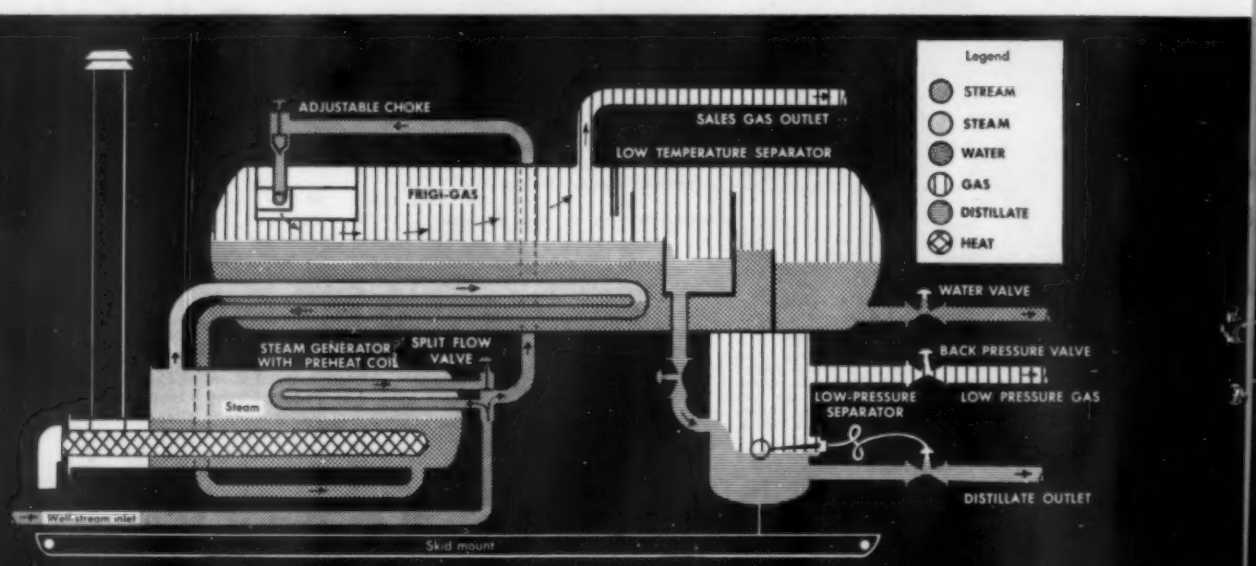

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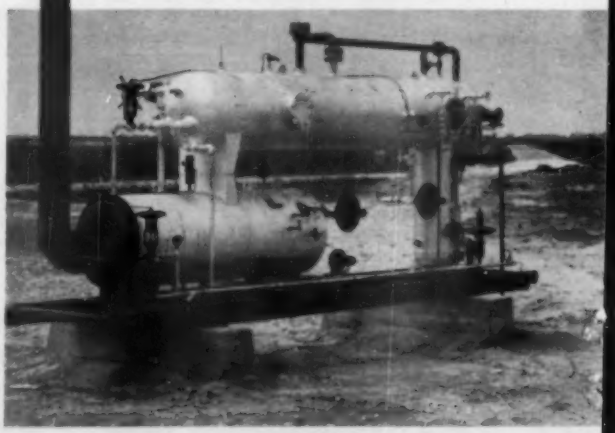

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